SAN FRANCISCO

Medium- and Heavy-Duty Zero-Emission Vehicles Blueprint

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- SF Department of Public Works
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[1] Leaders for Environmental Activism Reclaiming Their Health.

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Executive Summary

In 2021, the City and County of San Francisco (the City) secured funding from the California Energy Commission (CEC) to create a Medium- and Heavy-Duty (MDHD) Zero-Emission Vehicles (ZEV) Blueprint. The Blueprint builds upon the MDHD recommendations outlined in the City's 2018 *Electric Vehicle (EV) Ready Community Blueprint* to accelerate MDHD EV adoption with an interim goal of 10,000 MDHD ZEVs operating in the city by 2030.[i] This Blueprint details actions, tasks, and timeframes; identifies potential barriers and challenges; and designates roles for City departments and supporting partners to complete tasks and achieve the primary outcome for each strategy. Successful MDHD ZEV adoption is a specific focus of the City's ambitious Climate Action Plan (CAP)[ii] goal of net-zero emissions in San Francisco by 2040, and the California Air Resources Board's (CARB's) statewide goal of 100% zero-emission MDHD on-road vehicles by 2045 where feasible.[iii]

The following three strategies are the core of the MDHD Blueprint and provide the City with a path toward 10,000 MDHD ZEVs by 2030 and 100% zero-emission MDHD vehicles by 2045.

1. A large portion of San Francisco's fleets are domiciled in disadvantaged communities with high pollution ratings**. Jumpstarting the ZEV transition for small- and medium-sized fleets** through outreach partnerships, technical assistance, and piloting charging infrastructure models on City property will ensure no one is left behind.
2. Of critical importance is creating the conditions for **a strong MDHD ZEV Ecosystem**. The City must work with public and private entities to ensure readiness throughout the city to accommodate MDHD ZEVs for all fleets, including advancing charging infrastructure through land use policies, streamlined grid upgrades, and a ready workforce.
3. To reach adoption goals, the City must lead by example and **convert the municipal fleet to ZEV**. Developing and identifying funding for a detailed fleet replacement and infrastructure investment plan while navigating and planning for potential electrical grid constraints could result in achieving one-third of the City's 10,000 MDHD ZEVs goal by 2030 and support other fleets with information on streamlined charging infrastructure installation, acquisition of available incentives, IRA tax rebates, and other best practices.

Actions and tasks to achieve each of these strategies, and progress to date, are further outlined in the MDHD ZEV Adoption Strategies section. The timeline for accomplishing the work included in this Blueprint is 10 years. Near-term tasks that can be completed in 12-24 months are high priority and high urgency, crucial to the implementation of other tasks. These are either already in-process or can feasibly be completed in the near-term. Other tasks were categorized as medium-term (to be completed within 5 years to help achieve 10,000 MDHD ZEVs by 2030) and long-term (to be completed within 10 years to help achieve 100% zero-emission MDHD vehicles by 2045, where feasible with available technology).

The following nine key actions, which are detailed in the MDHD ZEV Adoption Strategies section along with associated agency leads, tasks, and timeframes, are recommended to advance the City toward its goals:

1. Increase access to ZEV technical assistance and education for small- and medium-sized fleets
2. Encourage shared Electric Vehicle Service Equipment (EVSE) with small fleet operators
3. Advance small- and medium-sized fleet charging pilot projects
4. Coordinate fleet operators to streamline grid upgrades
5. Develop a skilled workforce to support the MDHD ZEV transition
6. Develop land use laws to encourage the installation of ZEV charging infrastructure
7. Develop microhubs to shift last-mile deliveries from medium-duty vehicles
8. Establish a city fleet ZEV transition and infrastructure plan
9. Identify grid-integration and off-grid opportunities to support energization and increase public fleet resiliency

The MDHD ZEV Blueprint is aligned with the City's existing policy frameworks and promotes equity, public health, and economic vitality. All actions and tasks in the Blueprint are designed to create a more livable and equitable San Francisco, address disparities in charging options and services for small- and medium-sized fleets, reduce air pollution from MDHD vehicle emissions along major traffic corridors, and provide robust technical assistance to small- and medium-sized fleets to support their transition.

The Blueprint incorporates feedback from key partners, including City departments, small- and medium-sized fleets (with fewer than 50 vehicles), property owners, EVSE providers, community-based organizations, and others. The Blueprint is meant to serve the City and its partners a living guidebook and may be updated as needed as partner plans, available technology, and funding opportunities evolve.

Data Collection and Community Engagement

SF Environment gathered available data on MDHD registrations, traffic, and local electrical capacity and conducted outreach and community engagement with City fleet managers from key departments, small- and medium-sized fleet operators, and residents living in Bayview-Hunter's Point and southeast San Francisco. San Francisco's Bayview-Hunters Point District is one of the most disadvantaged communities (DACs) in the City, with a high volume of MDHD activity (see *Figure 1: The Caltrans Annual Average Daily Traffic (AADT) MDHD Vehicle Volume*). Bayview-Hunters Point community members participated in a DAC Needs Assessment Survey which included questions about car and EV ownership and usage, charging infrastructure quality and availability, and attitudes towards MDHD traffic.

Symbol	Upper value	Label
	≤ 710	0 - 710
	≤ 1646	711 - 1646
	≤ 4524	1647 - 4524
	≤ 10399	4525 - 10399

FIGURE 1: CALTRANS ANNUAL AVERAGE DAILY TRAFFIC (AADT) MDHD VEHICLE VOLUME

SF Environment's Small Fleets Survey compiled information on current fleet operations as well as barriers to ZEV adoption for small MDHD fleets. Of the responses received, 39% came from the Bayview-Hunters Point zip code of 94124.

Finally, SF Environment conducted interviews and site visits with City departments with the largest MDHD vehicle fleets to collect information on municipal vehicle inventory, operations, miles-traveled, and challenges to electrification.

SF Environment used the data and partner engagement to develop the strategies, actions, and tasks for this Blueprint, as well as to inform the development of a new tool, the MDHD Charging Suitability Mapping Tool.

To develop the tool, SF Environment worked with Arup, a planning and design firm, to identify data sources that could be used to help make siting decisions for MDHD EV charging infrastructure. These data were gathered from public or City-managed sources and were selected because of ease

of availability as well as relevance to the goal of siting MDHD EV charging infrastructure. With support from Arup, staff from SF Environment, the San Francisco Public Utilities Commission (SFPUC), the SF Office of the City Administrator (ADM), the Department of City Planning, and the San Francisco County Transportation Authority (SFCTA) prioritized the weighting criteria for siting MDHD EV charging.

The mapping tool, as depicted in *Figure 2: San Francisco MDHD Charging Suitability Mapping Tool*, identifies target locations for MDHD charging investment and can be used by the City as well as shared with other jurisdictions in the region to support MDHD ZEV adoption.

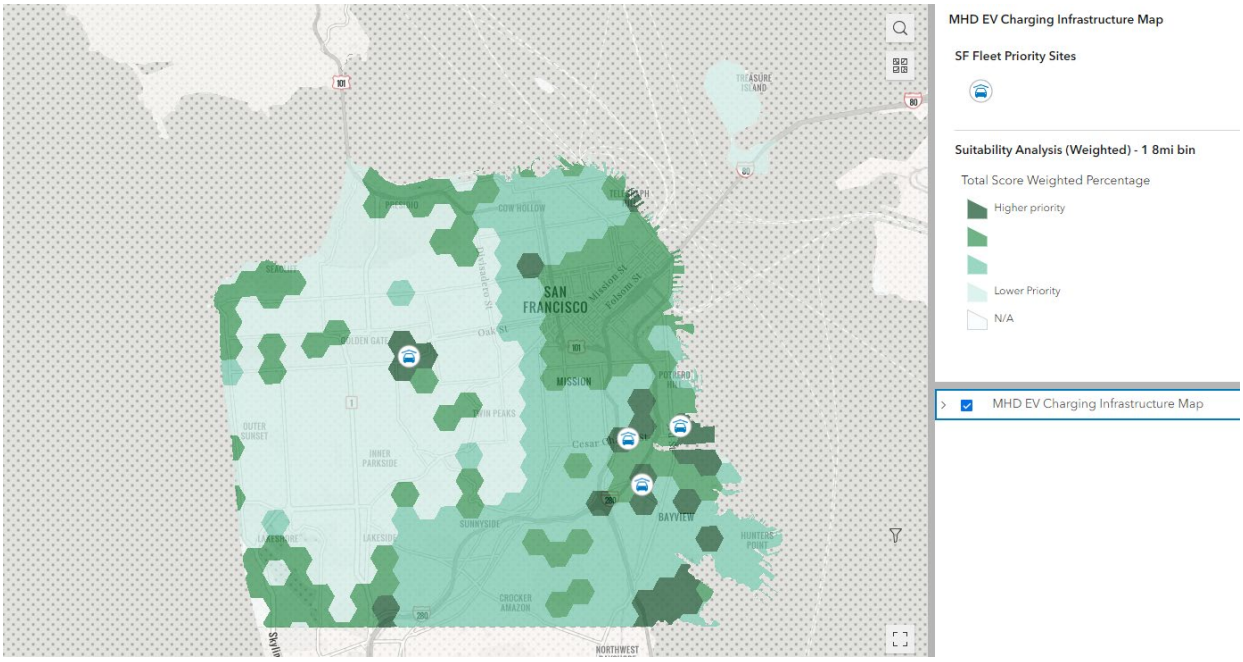

FIGURE 2: SAN FRANCISCO MDHD CHARGING SUITABILITY MAPPING TOOL

Addressing Barriers to MDHD ZEV Adoption

The City's MDHD ZEV Blueprint will take actions to ensure the City has sufficient fleet support and charging infrastructure in place to accommodate MDHD ZEV goals. Through community and public and private fleet engagement, SF Environment identified key challenges that drive this Blueprint's strategies. Addressing them will be a primary focus for SF Environment to ensure that actions can be accomplished and that the City can achieve its 2030 and 2045 MDHD ZEV adoption goals.

- High upfront vehicle and charging infrastructure costs and knowledge gaps for small- and medium-sized fleets to transition – SF Environment will launch an engagement and technical assistance program to connect small- and medium-sized fleets with resources and funding opportunities as well as share reliable information to address concerns around ZEV performance, operations, reliability.
- Electrical capacity requirements at sites deemed suitable for MDHD ZEV – SF Environment's mapping tool will support utilities in prioritizing grid upgrades at key MDHD locations, and

pilot project efforts will support testing a variety of charging models that can utilize existing electrical capacity.

- Current lack of public and shared-private MDHD ZEV charging – SF Environment and partners will advance pilot projects and explore the barriers that existing local regulations has on fleet charging or micro-logistics hubs, providing opportunities to adapt policy to streamline project development.

The City can address these challenges through technical assistance programs for small- and medium-sized fleets, interagency collaboration, and policy development, as described in the strategies, actions, and tasks of this Blueprint. The City will also continue to explore methods to address additional barriers, including limited model availability and suitability for fleet performance requirements, in partnership with state and federal agency programs supporting research, development, and demonstration efforts.

Resources Required to Implement this Blueprint

The resources required for fleets to both procure ZEVs and build charging and fueling infrastructure will be an ongoing challenge for the City. Developing educational and technical assistance programming for small- and medium-sized fleets and identifying ongoing incentives and funding opportunities is SF Environment's primary approach to this challenge. SF Environment anticipates the need to establish a new Citywide Urban Freight and Fleet Decarbonization team to coordinate across lead agencies identified in this Blueprint and to regularly engage and partner with fleet operators, property owners, utilities, vehicle manufacturers, charging and fueling infrastructure providers, and community organizations to accomplish this Blueprint's strategies and actions. To support the identified charging pilots, SF Environment will continue to collaborate with The SF Market, the Port of San Francisco, and ADM – Central Shops (Central Shops) on demonstration and pilot funding opportunities from regional, state, and federal entities as well as incorporate upfront community engagement.

In addition to CEC funding to complete this Blueprint, the City intends to allocate resources from the City's Carbon Fund to conduct deeper outreach with, and provide technical assistance to, small- and medium-sized fleets. Current and forthcoming incentives that can be leveraged with this planned outreach include SFPUC's EV Charge SF program, CARB's Hybrid And Zero-Emission Truck And Bus Voucher Incentive Project's (HVIP's) $30M Innovative Small E-Fleet set-aside[iv], CEC's EnergIIZE ZEV infrastructure grant program,[v] and the Bay Area Air Quality Management District's (BAAQMD's) $20 million for zero-emission Transport Refrigeration Units[vi]. Additionally, the City received $5M in state funding to install Level 2 municipal fleet charging infrastructure and is coordinating across the City fleet to access Inflation Reduction Act tax credits. Funds are supporting overall fleet coordination and ZEV transition planning efforts, and the effort has provided data and lessons learned on grid capacity and project implementation that will be leveraged for the MDHD ZEV transition. City departments with fleets will continually address funding allocations for ZEV procurement, and SF Environment will continually research available incentives for MDHD ZEV vehicle acquisition and charging infrastructure, as well as local, regional, state, federal, and other funding opportunities. Please see Appendix C Pilot Implementation Plan for more information on available funding opportunities.

Background

San Francisco is internationally recognized for its pioneering policies and programs on sustainability and climate change. The City and County of San Francisco (the City) has continuously reduced its annual greenhouse gas (GHG) emissions by enforcing new green building standards, investing in renewable energy systems, pursuing rigorous energy efficiency improvements, increasing the share of sustainable trips, and moving closer to zero waste being sent to the landfill.

The City has an ambitious Climate Action Plan (CAP)[vii] goal of net-zero emissions in San Francisco by 2040. Since 1990, the City has reduced its annual GHG emissions 48% below 1990 levels, while its population has increased by 12%.[2]

In 2022, the transportation sector was responsible for 45% of San Francisco's greenhouse gas emissions as shown in Figure 3 below,[viii] especially impacting state designated disadvantaged communities (DACs) near major traffic corridors and freeways.

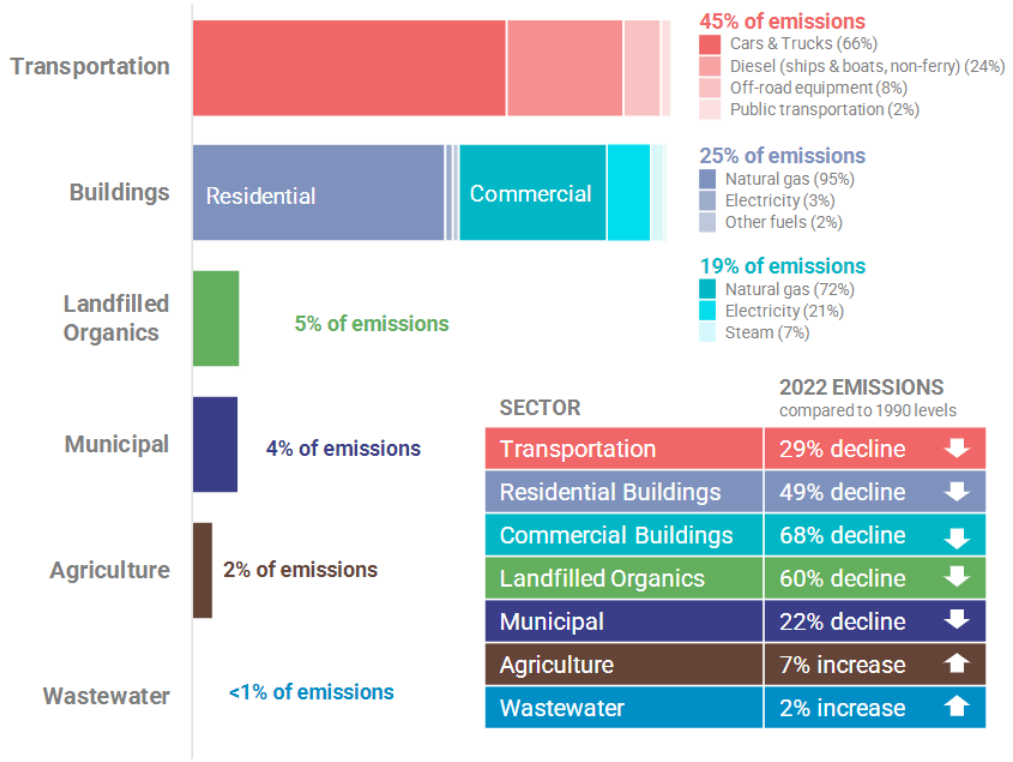

FIGURE 3: 2022 SAN FRANCISCO SECTOR-BASED GREENHOUSE GAS EMISSIONS

The City has long worked to reduce emissions from transportation. In 2019, the Mayor's Office and the San Francisco Environment Department (SF Environment) published "Focus 2030: Pathway to

[2] San Francisco began reopening its economy and lifting COVID-19 restrictions in 2022, after the COVID-19 lockdowns of 2020-21. However, the initial response to the COVID-19 pandemic in 2020-21 led to many unique circumstances and changes in behavior that continue to impact emissions, including remote work, changes to local and regional travel, and other economic impacts.

Zero Emissions,"[ix] a technical report demonstrating the pathway for San Francisco to ensure continued commitment and increased action to keep global warming to 1.5°C.[x] The report indicated that fuel-switching 25% of private cars, trucks, and other private-mobility modes could reduce projected 2030 GHG-emissions reduction by over 450,000 $MTCO_2e$. Also in 2019, the City adopted the *Electric Vehicle (EV) Ready Community Blueprint*,[xi] which identified six strategies to totally electrify the transportation sector by 2040.

With on-road cars and trucks the primary source of transportation sector emissions as shown in Figure 4 below, one of the proposed strategies focuses on accelerating medium- and heavy-duty (MDHD) zero-emission vehicle (ZEV) adoption, with an interim goal of 10,000 MDHD ZEVs operating in the city by 2030. The EV Ready Blueprint describes five proposed actions that the City can take to support the MDHD ZEV transition, including identifying, cataloging, and supporting pilots for MDHD fleets, working with City agencies and partners to clarify electrical and land use requirements for MDHD ZEV charging, and leveraging incentives and technical support mechanisms to support electrification of MDHD fleets citywide.

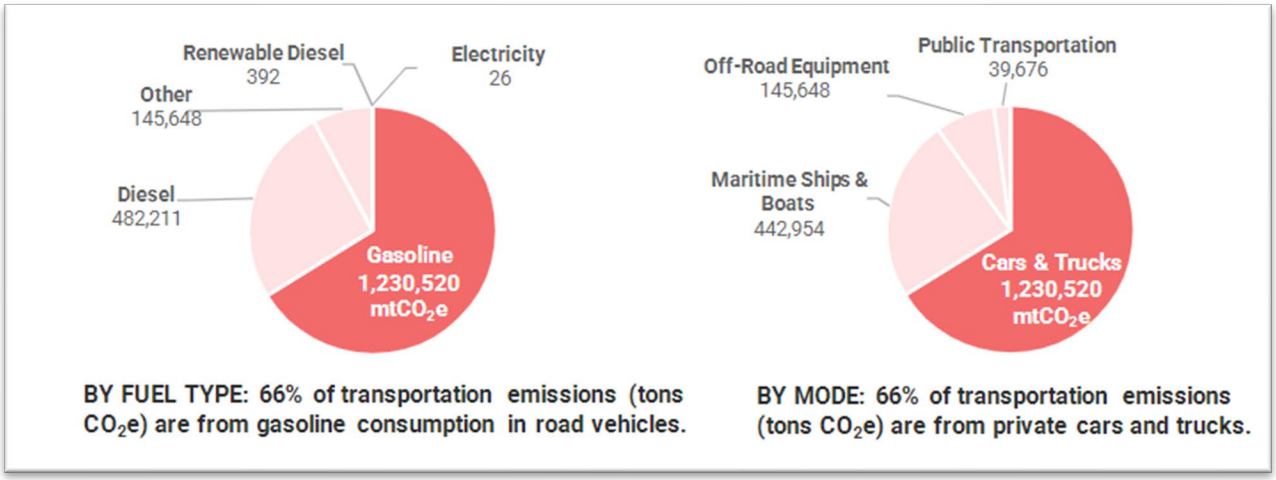

FIGURE 4: 2022 SAN FRANCISCO SECTOR-BASED GREENHOUSE GAS EMISSIONS – TRANSPORTATION SECTOR

In 2021, the City built on this effort with the CAP, which laid out aggressive plans for the City to reach net-zero emissions across all sectors by 2040—further increasing the City's efforts to address global warming. The CAP calls for the full electrification of the transportation sector with a specific emphasis on MDHD vehicles—five years earlier than the statewide goal.[xii]

As both a gateway and destination city for the region's goods movement, nearly 40,000 MDHD vehicles operate in San Francisco every workday.[xiii] Moreover, as of June 2023, there are nearly 18,000 MDHD vehicles registered in the city. The vast majority of these vehicles are fueled by diesel (68%) or gasoline (24%),[xiv] emitting not only GHGs such as carbon dioxide and nitrous oxide but also criteria air pollutants such as soot or particulate matter from the tailpipe[xv,xvi] disproportionately impacting air quality for DACs and other communities living or working near truck traffic or MDHD operational hubs. The sheer volume of diesel-powered MDHD traffic makes San Francisco one of the most polluted areas in the country when it comes to diesel particulate matter 2.5 ($PM_{2.5}$)[xvii]. As the

City seeks to accelerate transportation decarbonization to achieve its CAP goal of net-zero GHG emissions by 2040 while also reducing local air pollution,[3] it must double-down on its efforts to support the adoption of 10,000 MDHD ZEVs in the city by 2030.

San Francisco's ambitious goals are part of the ecosystem of state-level efforts to electrify the transportation sector. At the state level, the California Air Resources Board (CARB) has passed two key regulations that will have a major impact on fleets operating MDHD vehicles: the Advanced Clean Trucks (ACT) and Advanced Clean Fleets (ACF) regulations.

In June 2020, CARB established the ACT rule, which set goals and mandates for the types of MDHD vehicles that can be sold in California. The regulation requires manufacturers who certify Class 2b-8 chassis or complete vehicles with combustion engines to sell zero-emission trucks as an increasing percentage of their annual California sales from 2024 to 2035. By 2035, zero-emission truck/chassis sales would need to be 55% of Class 2b – 3 truck sales, 75% of Class 4 – 8 straight truck sales, and 40% of truck tractor sales. These sales requirements target the supply of MDHD ZEVs with the potential to increase the number of MDHD ZEVs on the road, which can support the development charging infrastructure industry and provide emissions reduction benefits to the public.

In April 2023, CARB established the ACF rule, which requires large carriers to transition their fleets to ZEVs by 2045, with deadlines for specific vehicle types starting in 2024. The regulation applies to trucks performing drayage operations at seaports and railyards; fleets owned by state, local, and federal government agencies; and high priority fleets, defined as entities that own, operate, or direct at least one vehicle in California and that have either $50 million or more in gross annual revenue, or that own, operate, or have common ownership or control of a total of 50 or more vehicles. The regulation affects MDHD on-road vehicles with a gross vehicle weight rating greater than 8,500 pounds, off-road yard tractors, and light-duty mail and package delivery vehicles. Small- and medium-sized fleets are not currently covered by the ACF rules, meaning that there will likely be less adoption among this cohort in the near-term.[4]

The combined effects of these two rules will accelerate the adoption of MDHD ZEV vehicles, especially among high-priority fleets.

[3] Full transportation sector decarbonization using ZEVs requires decarbonizing electricity and other zero-emission transportation fuel (e.g., hydrogen) generation. Local, state, and federal governments have set targets to achieve net-zero emissions in these sectors. For example, San Francisco has set an ambitious goal to achieve a 100% renewable electricity supply by 2025.
[4] For the purposes of this Blueprint, small fleets are defined as fleets with fewer than 10 MDHD vehicles. Medium fleets are defined as having between 10 and 49 MDHD vehicles.

Project Scope

The City's ambitious climate goals paired with the State's new regulations are set to rapidly increase the demand and use of MDHD ZEVs. But there will also be challenges that come with broad adoption and operation of these new vehicles. To better understand and plan for these challenges, the San Francisco Environment Department (SF Environment) secured funding from the CEC to create this MDHD ZEV Blueprint. To develop the Blueprint SF Environment gathered available data on MDHD registrations, traffic, and local electrical capacity and conducted outreach and community engagement to the City fleet, small-and medium-sized fleet operators, and residents living in DACs. SF Environment used its findings to develop the MDHD Charging Suitability Mapping Tool, which sites target locations for charging investment, as well as to identify the key strategies and actions to address the City's distinct challenges to transitioning both municipal and private fleets to MDHD:

Jumpstarting the ZEV transition for small- and medium-sized fleets

A lack of information and logistical and economic support for small- and medium-sized fleets in their transition to ZEV inhibits robust adoption.

- Increase access to ZEV technical assistance and education for small- and medium-sized fleets
- Encourage shared Electric Vehicle Service Equipment (EVSE) with small fleet operators
- Advance small- and medium-sized fleet charging pilot projects

A strong MDHD ZEV Ecosystem

A lack of accessible ZEV charging and fueling stations suitable for MDHD ZEVs citywide presents a significant barrier to adoption.

- Coordinate fleet operators to streamline grid upgrades
- Develop a skilled workforce to support the MDHD ZEV transition
- Develop land use laws to encourage the installation of ZEV charging infrastructure
- Develop microhubs to shift last-mile deliveries from medium-duty vehicles

Converting the municipal fleet to ZEV

A decentralized system of vehicle procurement and adoption, as well as domiciles dispersed across City properties with limited electrical capacity, challenges broad municipal adoption of MDHD ZEVs.

- Establish a city fleet ZEV transition and infrastructure plan
- Identify grid-integration and off-grid opportunities to support energization and increase public fleet resiliency

The Blueprint details actions, tasks, and timeframes; identifies potential barriers and challenges; and designates roles for City departments and supporting partners to complete tasks and achieve the primary outcome for each strategy. The City will undertake a number of tasks across these three strategies and actions to mitigate the primary barriers and advance the City's goal of transitioning 10,000 MDHD vehicles to ZEVs by 2030 and 100% MDHD ZEV by 2045. This Blueprint focuses on areas where the City can play a significant role in advancing MDHD ZEV adoption solutions that are not likely to occur through private sector actions in response to state and federal regulations. Paired

with federal and state policy targets, research and development programs, and demonstration and deployment funding, these actions at the local level can accelerate the MDHD ZEV transition across the city. Through ZEV acquisition planning, investing in infrastructure, and streamlining processes, the City can share information and learnings to pave the way for other jurisdictions, fleets, and regions to follow. This includes implementing two pilot projects—pending funding—that will help jumpstart EV adoption for small- and medium-sized fleets served by the Port of San Francisco and The SF Produce Market in Bayview-Hunters Point. For these pilots, funds will be used primarily for the purchase and installation of public/shared DC fast chargers, engineering and site design, participant and community engagement, and testing the shared model for more broad applications.

Based on existing planning efforts, impact on GHG emissions, and the City's jurisdictional purview, this Blueprint focuses on on-road MDHD vehicles (Classes 2b through 8), including trucks, non-revenue buses (e.g., employee shuttles), and other urban freight vehicles, with particular focus on local/regional, small- and medium-sized fleets.[5]

While ZEVs include hydrogen fuel cell EVs, this Blueprint primarily focuses on battery EVs and does not evaluate the unique challenges, benefits, or solutions for hydrogen vehicles or fueling infrastructure.[6] The City will continue to be involved in additional regional planning led by the Rocky Mountain Institute and potential projects to expand clean hydrogen fueling statewide through the California ARCHES Hydrogen Hub.

ARCHES H_2 Hub

ARCHES is California's initiative to accelerate renewable hydrogen generation, distribution, and utilization projects. It is a public-private partnership to create a sustainable statewide clean hydrogen (H2) hub using local renewable resources to produce hydrogen with the objective to fully decarbonize the regional economy.

While this Blueprint does not directly address H2, the City will follow this initiative and may seek opportunities to partner with ARCHES on projects that can serve the municipal and/or private fleets operating in San Francisco.

[5] MDHD vehicles excluded from this Blueprint include transit and school buses, private off-road equipment, and the maritime or air travel sectors. City off-road MDHD equipment – e.g., boom lifts – are considered as part of Strategy C: Convert the Municipal Fleet to ZEVs. Additionally, while the strategies outlined in this Blueprint can facilitate ZEV adoption and charging infrastructure deployment for long-haul freight or various specialized equipment, state and federal initiatives to advance research, technology demonstrations, and regional/national infrastructure networks will best support decarbonization for these use cases.

[6] Battery EVs run directly on electricity using rechargeable batteries to power an electric motor. Hydrogen fuel cell EVs use fuel cells to convert hydrogen into electricity to power the motor. Both vehicle types are ZEVs in that they produce zero tailpipe emissions. The City's goal to achieve a 100% renewable electricity supply and the federal government's clean hydrogen production programs will further reduce upstream GHG emissions from ZEVs.

The 2021 CAP is currently being updated and will be re-released in 2025 outlining new goals that may impact this Blueprint. Some of the key strategies and actions in this Blueprint will be included in the revised CAP and will undergo the Racial and Social Equity Analysis (RSEAT). RSEAT was designed to assess the impacts of emissions reduction strategies proposed in the 2021 CAP on racial and social equity. This tool was developed through a collaborative process involving SF Environment, People Organizing to Demand Environmental and Economic Justice (PODER), and Emerald Cities San Francisco Bay Area, and draws from a range of sources including the Equity Assessment Tool by Race Forward for the Zero Cities Project, the SF Office of Racial Equity (ORE), and the SF Planning Department's Community Equity Team. This tool will be used throughout the completion of the actions in this Blueprint to ensure convenience, affordability, and equitability for fleets of all types and sizes, ensuring none are left behind.

The Blueprint incorporates feedback from key partners, including City departments, small- and medium-sized fleets (with fewer than 50 vehicles), property owners, EVSE providers, community-based organizations, and others. The Blueprint is meant to serve the City and its partners a living guidebook and may be updated as needed as partner plans, available technology, and funding opportunities evolve.

MDHD Vehicle and Charging Landscape

MDHD vehicles (with a gross vehicle weight rating over 8,500 pounds) play a role across a range of sectors, from local/regional or long-haul people and goods movement to specialized work such as utility maintenance or street sweeping. These vehicles can range from heavy-duty commercial pickups, step vans, and trucks to buses, tractors, and refuse trucks.[xviii] In general, battery EVs can be more energy efficient than diesel vehicles and have lower maintenance costs than internal combustion engine (ICE) vehicles due to fewer moving parts.[xix] At the same time, available battery EV models may not be suitable for a particular fleet application due to the charging dwell time (which may take multiple hours depending on battery size and charging speed), range limitations (currently up to 300 miles),[xx] and heavier weight from batteries.[xxi] Given these limitations, the US Department of Energy (DOE) has prioritized a battery technology research agenda to improve battery EV performance.[xxii] Hydrogen fuel cell EVs address some of the limitations of battery EVs – e.g., they can refuel more quickly (e.g., in under 20 minutes for Class 8 vehicles),[xxiii] have longer ranges (currently up to 500 miles),[xxiv] and are lighter,[xxv] which can be useful for heavier-duty and longer-haul use cases with high uptime. However, hydrogen is relatively costly and distribution is not yet convenient for most transportation applications. The DOE has also prioritized a research agenda on hydrogen production, infrastructure, and fuel cell technology.[xxvi]

According to California Department of Motor Vehicles data, as of June 2023, there are 17,914 MDHD vehicles registered in San Francisco[xxvii]. As illustrated in Figure 5 below, well over half of these vehicles are medium-duty, with government representing the third-top use for these vehicles. As of December 2023, only 370 of the city's registered MDHD vehicles are ZEV, almost all of which are electric transit buses.[xxviii] The City's 2030 goal is to transition 10,000 MDHD vehicles registered in San Francisco to ZEVs. Transitioning 100% of the non-revenue municipal MDHD fleet to ZEV would advance the City toward its 2030 goal by over 25%. The vast majority of fleets operating MDHD vehicles registered in the city – over 85% as of 2020 – are small- and medium-sized fleets,

representing about 39% of registered MDHD vehicles. Thus, focusing on ZEV adoption for municipal fleets and small- and medium-sized fleets can rapidly advance the City toward its 2030 goal.

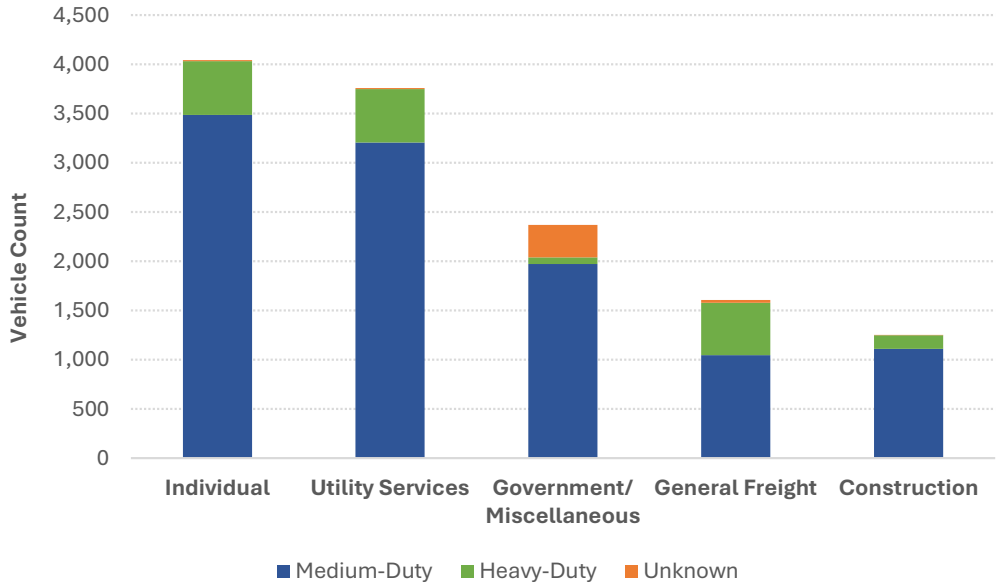

FIGURE 5: TOP 5 USES FOR MDHD VEHICLES REGISTERED IN SAN FRANCISCO (2023)

The city currently does not have sufficient charging infrastructure planned to support 10,000 MDHD ZEVs by 2030. While larger, well-resourced fleet operators are likely to install private depot charging, smaller fleets may rely on public or shared charging solutions due to site or funding constraints, if they park on rental property or on the street, or if they operate long-haul routes. Of the 1,112 publicly accessible charging ports available in San Francisco County in December 2024, none have a designated Maximum Vehicle Class for MDHD vehicles listed on the DOE's Alternative Fuels Data Center. To advance and accelerate MDHD ZEV adoption, chargers must be convenient and ubiquitous, but siting charging assets is challenging in San Francisco's dense urban environment. Sharp turns and reversing cause safety concerns for MDHD vehicles, creating a need for larger stalls/lots allowing for a larger turning radius or space to pull through, which are already in scarce supply in the city. Furthermore, compared to passenger cars, MDHD ZEVs require larger batteries and longer charging and dwell times than may be planned for at current public charging facilities that target light-duty vehicles. As a result, the existing charging infrastructure designed for passenger vehicles is inadequate to support the needs of MDHD ZEVs.

Additionally, the cost and timelines involved in installing charging stations capable of accommodating MDHD vehicles is significantly higher than those for smaller vehicles. These stations require specialized equipment, such as high-capacity charging stations and power distribution systems, which increases overall installation costs. Public and private partners have hesitated to invest in these charging stations due to the substantial financial commitment involved. This can be compounded by changing land use laws that require a Conditional Use Authorization (CUA) for fleet charging uses. CUAs can be costly and time consuming to complete and raise

uncertainties that a given fleet charging project would be approved, delaying private sector investment.

Strategy B of this Blueprint is focused on actions that facilitate the deployment of charging to accommodate MDHD ZEVs and provide opportunities for innovative approaches to make charging investments competitive with other competing demands for use of space.

Public Sector ZEV Adoption

Transitioning the municipal fleet to ZEV will significantly advance the City toward its adoption goals, and is the primary focus of Strategy C of this Blueprint. The City fleet will lead by example through the transition of its approximately 8,500 non-revenue vehicles (excluding transit and school buses), nearly 3,500 of which are MDHD and include specialized vehicles such as street sweepers. Currently, only 7% of the light-duty, non-public safety fleet has been converted to ZEVs, and the City has only 18 MDHD ZEVs in the fleet made up of 1 ton vans or shuttle buses.[7] The City's fleet is covered by CARB's ACF rules, which requires the fleet to purchase MDHD ZEVs as a portion of all MDHD purchases, starting in 2024. By 2027, ACF requires that all MDHD purchases are ZEVs.

Many City-owned properties where MDHD fleet vehicles domicile have limited electrical capacity, which restricts the number of chargers that can be added to these sites without costly grid upgrades. The City faces major funding challenges for these infrastructure projects and MDHD ZEV purchases, as well as issues that arise from San Francisco's unique decentralized fleet management system, which segments fleet management across a variety of departments. Specialized MDHD fleet vehicle availability remains limited and, more broadly, the MDHD ZEV and charging/fueling infrastructure markets are volatile. To meet its goals, the City will need to address the lack of ZEV charging and fueling infrastructure at City-owned properties and support departments in meeting statewide adoption mandates.

Resources for Small- and Medium-Sized Fleets

To ensure equitable charging infrastructure citywide that serves fleets of all types and sizes, the City must proactively address the unique needs of small- and medium-sized fleets. CARB's ACF rules require large entities and fleets to electrify, but businesses with fleets of fewer than 50 vehicles are exempt. This exemption means that small- and medium-sized fleets will require a strong incentive to voluntarily electrify their fleets, and targeted support will be needed to engage and assist them in the transition. Without a mandate or targeted support for electrification, small- and medium-sized fleets may continue to release emissions, negatively affecting our environmental and public health. Additionally, siting and electrical capacity requirements for small- and medium-sized fleets will require a fresh look at how charging for these fleets is financed and installed. Strategy A in this Blueprint is primarily focused on jumpstarting the small-and medium-sized fleet ZEV transition to address these concerns.

In San Francisco, focusing on small- and medium-sized fleets is also an equity and environmental justice priority. Many of these small- and medium- sized fleets—and over 30% of all registered MDHD vehicles in the city (see Figure 1)—are located in the Bayview-Hunters Point District, a part of the city

[7] Data as of November 2024.

known as the “Industrial Triangle”. This area, as shown in Figure 6 below, is one of the most historically polluted in the City and has been designated by the City’s Environmental Justice Map[xxix] as a DAC (see Figure 7 on the following page). Bordered by two freeways (US 101 and 280), residents and businesses in and around the Industrial Triangle are disproportionally impacted by diesel particulate matter and other pollution, including noise.

FIGURE 6: A MAP OF BAYVIEW-HUNTERS POINT/INDUSTRIAL TRIANGLE

Over 700 small- and medium-sized businesses operate MDHD vehicles in this part of the city, including the city’s wholesale produce distributor, The SF Produce Market, as well as parts of the Port of San Francisco.

Through implementation of BAAQMD’s diesel engine retrofit program, the City learned that while large entities and fleets have the resources to access incentives and technical assistance like the retrofit program, small- and medium-sized companies do not. Small fleets experience participation barriers which make them difficult to reach, including a lack of dedicated staff and time to build awareness of program offerings and benefits, and a lack of funds to contribute as match for incentives. Slim profit margins and poor cash flow make it difficult for small businesses to invest in or finance costly fleet upgrades and are therefore often left out of incentive and rebate programs. Additionally, charging infrastructure can be difficult to access, whether because of lack of physical space, financing, or both. Many small fleets rely on street parking, giving them no private space to deploy charging stations. The fleets that do have their own parking facilities will need to contend

with the high costs and long timelines of electrical system upgrades. Furthermore, larger businesses and fleets have the resources to turn over their vehicles more frequently and, as they begin to procure ZEVs to meet state mandates, may flood the market with lower-cost, used internal combustion engine (ICE) vehicles, further disincentivizing smaller fleets from pursuing new, higher-cost ZEVs, even though they may otherwise realize operational savings.

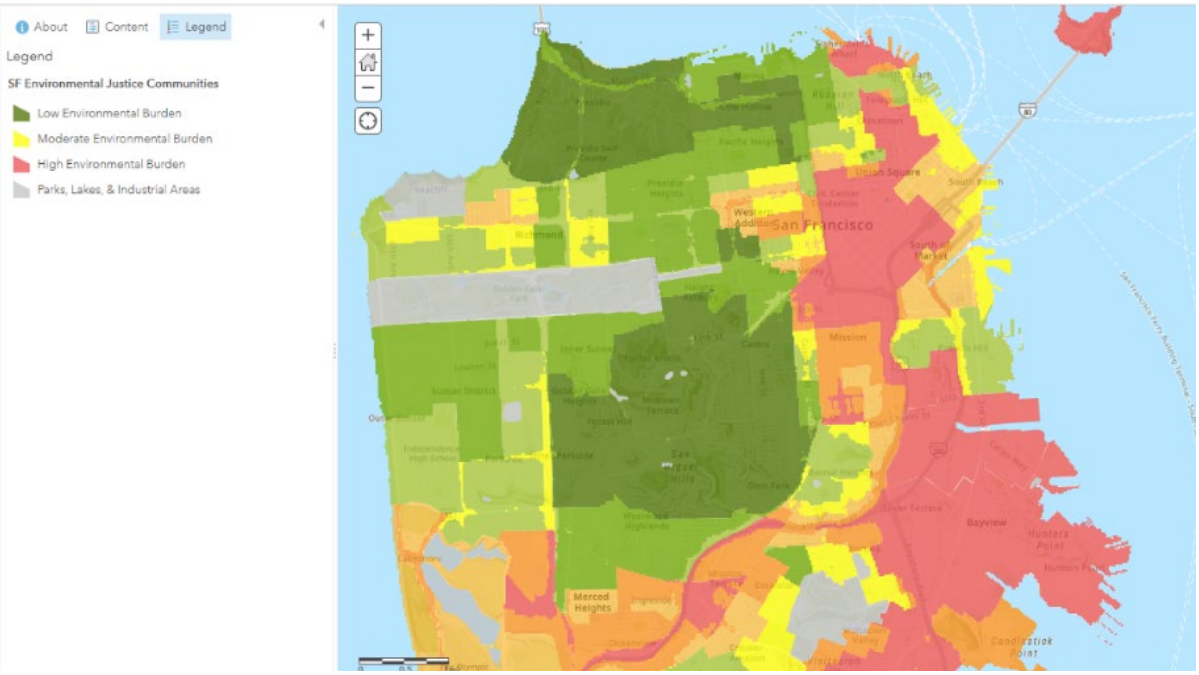

FIGURE 7: SAN FRANCISCO'S ENVIRONMENTAL JUSTICE COMMUNITIES MAP

Community and Partner Outreach and Engagement

Community and partner engagement was critical to the development of the strategies and actions outlined in the Blueprint. SF Environment worked with Central Shops and the San Francisco Clean Cities Coalition to establish an MDHD ZEV Technical Advisory Committee (TAC) and conduct engagement activities across three key audiences: the municipal fleet, small- and medium-sized commercial fleets, and impacted communities.

Central Shops

Central Shops, or the Fleet Management Division within San Francisco's Office of the City Administrator (ADM), manages and maintains the City's fleet. It provides fleet services to roughly 50 City departments with a combined municipal fleet total of approximately 8,500 units. It is responsible for fleet policy, complying with local and state regulations, asset management, maintenance and repairs, vehicle leasing, motor pools, fueling services, vehicle acquisitions and dispositions, equipment specifications, the alternative fuel program, and other feet management activities. It operates six maintenance and repair facilities with 100 staff members, including automotive craft workers, machinists, welders, materials specialists, administrative and policy staff, and others. Central Shops facilitated most outreach tasks for the municipal fleet and had a representative participate in the MDHD ZEV TAC.

San Francisco Clean Cities Coalition (SFCCC)

San Francisco was a founding member of the US DOE's Clean Cities Coalition 25 years ago. SF Environment has hosted SFCCC for nearly two decades and works with vehicle fleets, fuel providers, community leaders, and other partners to save energy and promote the use of domestic fuels and advanced vehicle technologies. It has been instrumental in crafting legislation that reduces petroleum reliance, advances deployment of alternative-fueled vehicles, ensuring the City meets its ambitious climate goals, and disseminating information about these successful policies and initiatives statewide and nationally. SFCCC was critical in designing and distributing the Small Fleets Needs Assessment Survey and Disadvantaged Community Needs Assessment Survey and leveraging the expansive Clean Cities Coalition network to collect input and best practices that will help shape outreach tactics and deliverables.

MDHD ZEV Blueprint Technical Advisory Committee (TAC)

The TAC brought together public sector partners, utilities, City departments, community-based organizations, local businesses, and fleet representatives directly engaged in MDHD fleet electrification in San Francisco to guide the development of the Blueprint (see Appendix B for list of TAC members and organizations). The TAC provided a forum for coordination and collaboration to ensure that these partners informed and reviewed key Blueprint components.

TAC OBJECTIVES

- Provide an opportunity for all members to aid in the design, development, and review of the Blueprint components and final Blueprint;
- Discuss challenges to fleet electrification and the impacts of charging siting and installation on the community;
- Share data, best practices, and messaging to develop cohesive solutions that support the Blueprint's goals; and
- Provide oversight to ensure that the resulting Blueprint and its contents fulfill their needs, address their concerns and interests, and are implementable within the allocated timeframe.

SF Environment hired a professional facilitator to prep, facilitate, and complete follow-up tasks for each TAC meeting. Having a neutral, third-party facilitator was important to the success of the meetings because a facilitator provided a structured, inclusive space for group members to be productive, creative, and efficient.

The TAC met virtually six times during the development of the Blueprint and provided valuable feedback on developing the Small Fleets Needs Assessment Survey, the Disadvantaged Communities Needs Assessment Survey, Municipal Fleet Interviews, and the Pilot Project Draft Implementation Plan.

The Blueprint's community and partner engagement led to important findings related to the municipal fleet, small- and medium-sized fleets, and disadvantaged communities.

Municipal Fleet Engagement

San Francisco's municipal fleet contains nearly 3,500 MDHD vehicles that are used across multiple departments to perform City operations and advance City goals and priorities. CARB's ACF regulations require that the City's municipal MDHD fleet must begin to electrify in 2024. While vehicle requisitions originate from individual departments, vehicles are maintained, managed, and repaired by the City's Central Shops. Each requisition must specify the vehicle type and provide budget, as approved by the Board of Supervisors. This disparate approach is a significant barrier to the City's goal of electrifying the City Fleet and delays compliance with CARB's ACF regulations.

A high-level study done as part of the Blueprint found that overall, electrifying the City MDHD fleet will require roughly 15 MWh/day of power demand. Central Shops will be completing a more in-depth study of power demand and electrification of the entire fleet through the 2024 Public Fleet Electrification Planning Assistance Program funded by the Metropolitan Transportation Commission (MTC).

SF Environment conducted a series of interviews with high priority departments to understand the challenges they face in beginning to electrify their MDHD fleets. Interviews and site visits were conducted with the City departments with the highest number of MDHD vehicles, including Recreation and Parks Department (REC), the San Francisco Municipal Transportation Agency (SFMTA), and the Department of Public Works (DPW). These interviews were intended to collect

information on vehicle inventory, operations, miles-traveled, and challenges to electrify. Please see Appendix F for detailed vehicle inventories and interview feedback.

SF Environment and Central Shops interviewed REC's Fleet Manager and an Electrical Supervisor, SFMTA's Revenue Support Fleet Director, and DPW's Heavy Equipment Operations Supervisor.

KEY TAKEAWAYS

All interviewees shared unique perspectives about the challenges of electrifying their department's fleets, given specific use cases and electrical demand and availability. However, across all interviews, key themes emerged that were essential to the development of the Blueprint.

FUNDING FOR VEHICLES & CHARGING INFRASTRUCTURE

Across all departments, budgets for vehicle procurement and charging infrastructure will need to substantially increase in order to meet the City's goals and satisfy CARB's ACF Regulations.

VEHICLE MODELS & AVAILABILITY

The current EV market lacks many specialized vehicle types. There are also several types of power take-off units and other critical equipment that may impact the battery life and duty-cycles of some ZEVs within City fleets.

NEED FOR CITY LEADERSHIP & GUIDANCE

While these departments are taking steps independently of each other, all interviewees expressed a strong desire for a point-person within the City to manage all fleet electrification projects in a holistic way. Since these interviews have taken place, Central Shops has taken on a leadership role and is working with departments to identify funding and technical solutions for electrifying the City light-duty and MDHD fleets.

RELIABILITY OF EVS IN EMERGENCY SITUATIONS AS COMPARED TO ICE VEHICLES

Many vehicles across the City's fleets are critical for emergency response during times of severe weather or earthquakes. If those incidents also result in broad power outages, there is concern that City departments will be unable to charge these vehicles.

INTEREST IN HYDROGEN FUEL CELL VEHICLES

All interviewees expressed some interest and desire for more education about hydrogen fuel cell vehicles as a potential solution to some of the challenges around battery electric vehicles.

San Francisco Small Fleets Survey

CARB's ACF rules require priority fleets with 50 or more MDHD vehicles or more than $50 Million in total revenue to electrify, but entities and fleets with fewer than 50 MDHD vehicles are exempt. Based on SF Environment's experience in promoting diesel engine pollution controls and retrofits,

these small- and medium-sized fleets are often hard to reach and harder to serve. They could be left stranded without financial and technical assistance to electrify.

Creating a process that engaged these parties upfront allowed SF Environment to identify participation barriers to ZEV adoption and allowed City staff to identify key strategies to include in this Blueprint so that small- and medium-sized fleets can benefit from the environmental and operational savings of ZEV technology. To supplement the SF Small Fleets Survey findings, SF Environment reviewed the national level survey conducted by Dream.org,[xxx] a national advocacy organization focused on promoting an equitable green economy.

KEY TAKEAWAYS

The findings from the San Francisco Small Fleets Survey conducted by SF Environment and the national study of small fleets by Dream.org shed light on small fleet concerns regarding the high upfront costs of ZEVs, limited model availability, charging infrastructure installation expenses, and a lack of knowledge about available incentives and technologies. Moreover, skepticism stemming from previous negative experiences with government regulations, such as mandates for diesel exhaust fluid and diesel particulate filters, adds to the apprehension among small fleet operators. Despite the challenges, there are encouraging signs, such as positive feedback from early adopters of ZEV technology highlighting lower maintenance costs and operational benefits. Government incentive programs such as CARB's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) and CEC's EnergIIZE program offer financial support tailored to small fleets. Additionally, resources such as Cal Fleet Advisors provide technical assistance to navigate the transition process. Please see Appendix E for complete small fleet survey sample and findings.

Disadvantaged Communities Survey

San Francisco's high volume of MDHD traffic makes the city one of the most polluted areas in the country from diesel $PM_{2.5}$ (Figure 8). Emissions are highest along heavily traveled highways: US 80, US 101, Interstate 280, and feeder roads that connect to the city's industrial and distribution areas. Adjacent neighborhoods—Bayview-Hunters Point, the Tenderloin, South of Market Area, and parts of Civic Center—are disproportionately burdened by this pollution and have been certified disadvantaged communities (DACs) by CalEnviroScreen 4.0.[xxxi] These neighborhoods are often home to low-income earners and communities of color who are negatively affected by poor air quality and social disinvestment. In addition to high pollution, these neighborhoods are also home to some of the highest concentration of domiciled fleets.

MDHD ZEV adoption has the potential to mitigate many negative effects associated with trucking, potentially bringing benefits to local air quality and overall emissions reduction. To ensure that these benefits flow to communities that have been most affected by climate change and pollution, SF Environment ran a survey of residents in Bayview-Hunters Point asking about attitudes towards electrification and current conditions of the neighborhood to help determine community needs. See Appendix D: Disadvantaged Community Needs Assessment for survey questions and detailed findings.

Annual average concentration of PM2.5 (µg/m3) by census tract, San Francisco, 2020

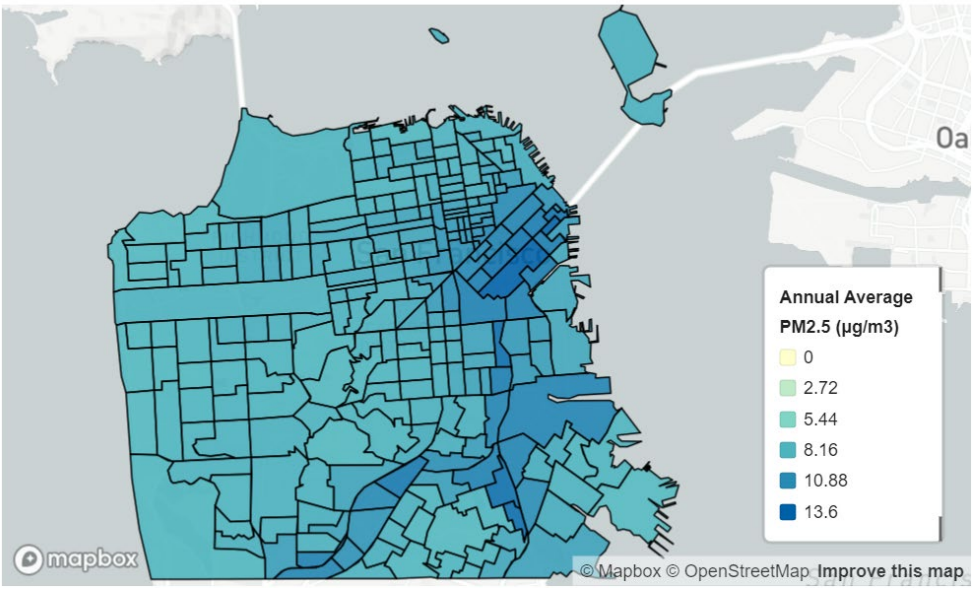

FIGURE 8: MAP OF PM2.5 CONCENTRATION. SOURCE: SFDPH

KEY TAKEAWAYS

The DAC Needs Assessment Survey shows that Bayview-Hunters Point residents broadly support SF Environment's MDHD ZEV goals, while also demonstrating the challenges that the neighborhood faces from pre-existing conditions. A lack of charging network for both personal light-duty vehicles and MDHD vehicles prevents residents and fleets from transitioning to ZEVs.

88% of Bayview-Hunters Point residents say they or someone in their household owns a personal vehicle. A plurality (49%) uses that car multiple times a day.

While Bayview-Hunters Point residents tend to think the neighborhood experiences about the same amount of car traffic as other parts of SF, a majority (54%) recognize that there are more MDHD vehicles traveling through the neighborhood than other parts of the city (Figure 9 below).

Now, please think about medium-duty and heavy-duty vehicles like delivery trucks, buses, and semi-trucks.

Would you say that there are **(PINWHEEL ROTATE)** <more medium- and heavy-duty vehicles traveling through Bayview-Hunters Point than in other parts of San Francisco>, <about the same amount as in other parts in San Francisco >, or <fewer medium- and heavy-duty vehicles in Bayview-Hunters Point than in other parts of San Francisco>?

	BVHP	ALL SE SF
More than in other parts	54%	51%
About the same as other parts	29	18
Fewer than in other parts	11	5
--		
Not sure	6	25

FIGURE 9: DAC SURVEY QUESTION: PERCEPTION OF MDHD TRAFFIC

The top concern about these vehicles in this neighborhood is air pollution (35% top concern), followed by safety for cyclists and pedestrians (17%). Increased traffic (13%) and taking up parking (12%) were also key concerns for survey respondents. Noise (7%) was a more minor concern, and less than 10% of survey respondents reported no concerns with MDHD vehicles. One survey

respondent noted that the community has “heavy industrial [sp] workers that bring vehicles that pollute the air [and they] need to take initiative and consider using evs [sp]” (Figure 10 below).

Which of the following concerns you the most about medium and heavy-duty vehicles in Bayview-Hunters Point? **(RANDOMIZE)**

	BVHP	ALL SE SF
They pollute the air	35%	32%
They make roads less safe for cyclists and pedestrians	17	17
They cause traffic	13	14
They take up parking	12	10
They make a lot of noise	7	8
Other	7	4
None of these concern me	7	10
--		
Not sure	1	4

FIGURE 10: DAC SURVEY QUESTION: CONCERNS ABOUT MDHD TRAFFIC

58% majority of Bayview-Hunters Point residents say installing new public chargers would be beneficial for the neighborhood. At the same time, survey responses and related community and TAC meetings surfaced potential concerns around increased traffic, parking access, facility security and maintenance, electric grid reliability, and overall project governance, which are considerations the City should take into account as it pursues both public and private charging projects in this community.

Currently, the City of San Francisco is working to develop a public fast charging plaza in Bayview-Hunters Point as part of its CEC-funded Phase II EV Ready Community Blueprint work. This plaza will offer fast and convenient charging which can ease the transition to ZEVs. While the plaza is intended to support light-duty vehicles, some medium-duty vehicles in the area would also have access to this amenity.

In addition to the planned fast-charging plaza, strategies and pilot projects described in this Blueprint will help expedite the transition to MDHD ZEVs in DACs and facilitate MDHD charging infrastructure deployment.

Barriers to MDHD ZEV Adoption

Throughout TAC meetings and one-on-one discussions with participants, municipal fleet interviews, and fleet and community surveys, several themes emerged highlighting the challenges to transitioning to ZEVs for MDHD vehicles.

LIMITED VEHICLE MODELS & AVAILABILITY

The current ZEV market lacks many specialized vehicle types for different job functions, particularly heavier-duty, longer-haul, and specialized applications.

INADEQUATE TECHNOLOGY PERFORMANCE/SUITABILITY FOR A FLEET'S NEEDS

Even if there are models in a fleet's desired vehicle category, performance – e.g., range or carrying capacity – may not meet the fleet's operational (e.g., daily usage) needs and can by impacted by factors such as road grade, route variability, and temperature. There are also several types of power take-off units and other critical equipment that may impact the battery life and duty cycles for some vehicles. Hydrogen fuel cell vehicles could be one potential solution to some of the challenges around battery electric vehicles, including supporting longer driving ranges and quicker refueling.

HIGH UPFRONT COST FOR VEHICLES

While the total lifetime cost of ownership between battery EVs and diesel or gasoline vehicles may be at parity for some vehicle classes due to operational cost savings (e.g., Class 2b/3 freight vehicles),[xxxii] the upfront cost continues to be higher on average compared to ICE vehicles, with retail prices ranging from 15% to 45% higher for Class 2b/3 and 43% to 86% higher for Classes 4-8 freight vehicles.[xxxiii] Currently available purchase incentives may only cover some of this different in upfront cost, although lithium-ion battery cost and performance continue to improve.[xxxiv]

HIGH COST AND TECHNICAL REQUIREMENTS FOR CHARGING/REFUELING INFRASTRUCTURE

ZEV operators must either install private charging (or hydrogen refueling) infrastructure or – particularly if the fleet domicile location has limited space or is leased or if duty cycles require en-route charging – identify shared-private or public charging solutions that may or may not be sited in convenient locations for individual fleets. Furthermore, charging infrastructure for MDHD vehicles with high performance requirements may require fast-charging solutions that require significant electrical capacity and potentially new electrical equipment and utility grid upgrades, which can be costly and take 1-5 years. Permitting and zoning requirements can also take time or present regulatory challenges for certain project configurations. Additionally, there may be uncertainty around the cost impacts of electricity and/or hydrogen as compared to diesel or gasoline fuel.

DIFFERENT OPERATIONAL (REFUELING/MAINTENANCE) PRACTICES

Operating ZEVs will require a shift in ongoing fleet operations and may adjust duty cycles to account for charging/refueling for a longer period or at a new location. While maintenance will typically be simpler for EVs due to limited moving parts, training will be required to perform ongoing maintenance and repairs. Charging equipment must also be regularly maintained and/or fleet

operators must rely on third-party charging operators to maintain reliability and mitigate vandalism. Additionally, the ZEV and charging/fueling market is currently volatile; e.g., fleet operators have seen companies in this space go out of business and become unable to support ongoing operations.

UNCERTAINTY ON HOW TO GET STARTED

Knowledge and resource gaps impact fleet operators' ability to start the process of planning for, piloting, and/or completing a transition to ZEVs.

RELIABILITY OF EVS AND CHARGING INFRASTRUCTURE AS COMPARED TO ICE VEHICLES, PARTICULARLY IN EMERGENCY SITUATIONS

Fleet or third-party charging infrastructure operators may face challenges in maintaining charging equipment, as well as vandalism at public sites. Additionally, for fleets such as those in the City fleet that are critical for emergency response during times of severe weather or earthquakes, power outages would challenge their ability to charge/refuel and could limit their ability to respond effectively. At the same time, there may be limited awareness among fleets that San Francisco is a relatively low-risk area for power interruptions and less susceptible to wildfire challenges or public power safety shutoffs during times of severe weather.

MDHD Charging Suitability Mapping Tool

In 2019, as part of the EV Ready Community Blueprint, SF Environment staff partnered with Google's Environmental Insights Explorer Team to develop a blueprint mapping tool for light-duty vehicles and charging infrastructure. SF Environment built upon this work to create the MDHD ZEV Blueprint Charging Suitability Map, a tool focused specifically on siting charging for MDHD EVs. In collaboration with Arup, a planning and design firm, SF Environment used a suitability analysis based on a multicriteria weighting system as the basis for the map. The suitability analysis identified Southeast San Francisco as a target location for charging infrastructure and investment specifically geared towards MDHD vehicles.

Data Collection and Prioritization

SF Environment and Arup identified key data sources to help make siting decisions for MDHD EV charging infrastructure, including truck traffic, MDHD vehicle registrations, zoning designations, environmental justice indicators, and utility grid capacity. These data were gathered from public or City-managed sources and were selected because of ease of availability as well as relevance to the goal of siting MDHD EV charging infrastructure. For complete details on the data collection and prioritization process, please see Appendix G: Charging Suitability Mapping Tool Data Collection and Prioritization.

After gathering the data, Arup led a workshop for City staff from SF Environment, SFPUC, SF Department of City Planning, SF County Transportation Authority (SFCTA), and ADM – Central Shops to weigh in on which data sources were the most important considerations when thinking about siting MDHD EV charging infrastructure. Arup's facilitation ensured participants understood the use cases for the map as well as the tradeoffs between utilizing one data source over another.

In the workshop, City staff agreed that the top prioritization criteria should be siting charging infrastructure in priority populations (DACs and low-income communities).

MDHD Charging Suitability Map

The San Francisco MDHD Charging Suitability Mapping Tool[xxxv] is an online interactive dashboard that can be used to explore areas best suited for MDHD charging infrastructure investment. The static map show in Figure 11 below was generated from the tool and shows priority areas for charging investment in dark green. In addition to depicting the suitability analysis, the mapping tool is able to display each of the individual layers that went into creating the analysis.

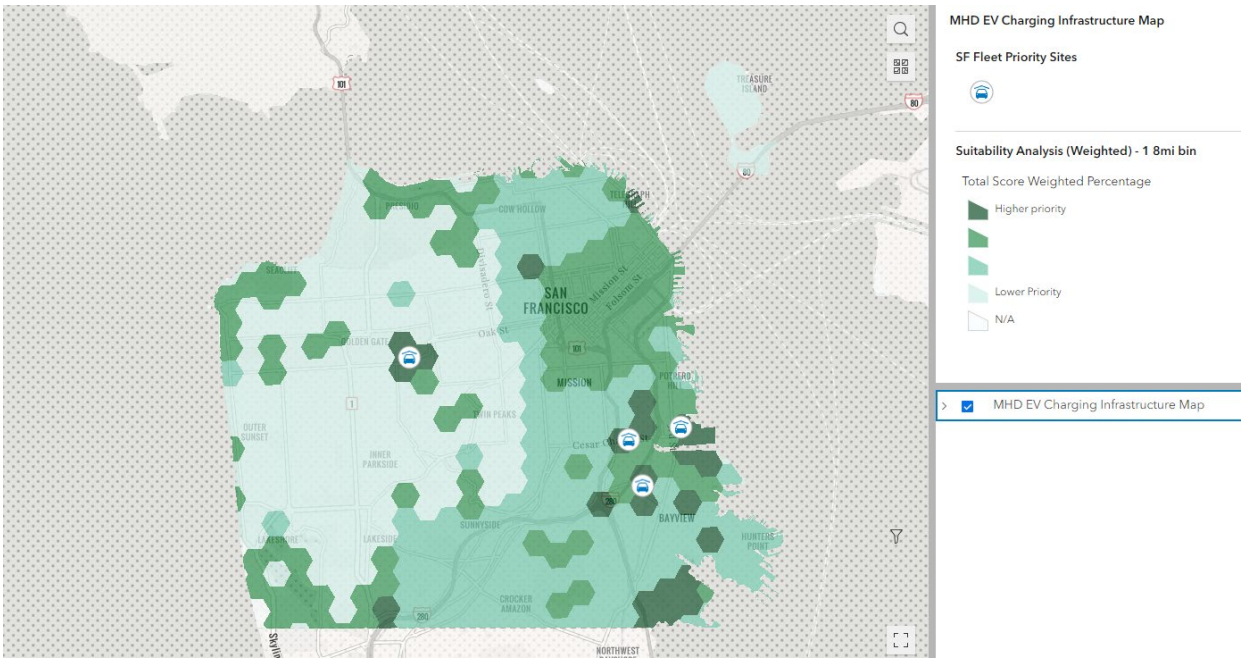

FIGURE 11: SAN FRANCISCO MDHD CHARGING SUITABILITY MAPPING TOOL

According to the data collected and the prioritization exercise, the highest priority region for charging investment lies within Southeast San Francisco. This is due to the presence of priority communities, public fleet priority sites, a high density of parcels designated as PDR Production, Distribution, and Repair (PDR) Districts by the land use code, and a high density of MDHD vehicles domiciling in the vicinity. The map also highlights City fleet domicile locations that host a large number of MDHD vehicles (as of 2024) and are potential candidates to install depot charging or a fast-charging hub for the City fleet. The City will investigate the feasibility of siting charging infrastructure at these sites as part of MDHD ZEV Adoption Strategy C: Convert the Municipal Fleet to ZEVs. This information can inform SFPUC and PG&E investment for grid upgrades. The SFPUC, for example, plans to incorporate GIS layers from the MDHD Charging Suitability Mapping Tool into its internal GIS system, where feasible, to support load planning and evaluate locations for future infrastructure investments.[8] SF Environment can also use this model to further inform high priority locations for charging pilots.

While the data collected was primarily from public sources, future iterations of this tool could potentially incorporate community and private fleet input as well as data purchased from private companies. As a next step, SF Environment staff can look into private data sources like Streetlight and others to get a more granular idea of where MDHD vehicles are currently traveling within San Francisco.

[8] To maintain customer data privacy, the public-facing mapping tool does not currently highlight SFPUC-served locations or integrate SFPUC-managed distribution grid capacity.

MDHD ZEV Adoption Strategies

The following strategies and actions (Figure 12) aim to accelerate ZEV adoption for the whole MDHD ecosystem while also targeting two key audiences for more specific support: the municipal fleet and small- and medium-sized fleet operators. The timeline for accomplishing the work included in this blueprint is 10 years. Near-term tasks that can be completed in 12-24 months are high priority and high urgency, crucial to the implementation of other tasks. These are either already in-process or can be or can be feasibly completed in the near-term. Other tasks were categorized as medium-term (to be completed within 5 years to help achieve 10,000 MDHD ZEVs by 2030) and long-term (to be completed within 10 years to help achieve 100% zero-emission MDHD vehicles by 2045, where feasible with available technology).

Strategy	Action
A. Jumpstart the ZEV Transition for Small- and Medium-Sized Fleets	1. Increase access to ZEV technical assistance and education for small- and medium-sized fleets 2. Encourage shared Electric Vehicle Service Equipment (EVSE) with small fleet operators 3. Advance small- and medium-sized fleet charging pilot projects
B. Strengthen the MDHD ZEV Ecosystem	4. Coordinate fleet operators to streamline grid upgrades 5. Develop a skilled workforce to support the MDHD ZEV transition 6. Develop land use laws to encourage the installation of ZEV charging infrastructure 7. Develop microhubs to shift last-mile deliveries from medium-duty vehicles
C. Convert the Municipal Fleet to ZEVs	8. Establish a city fleet ZEV transition and infrastructure plan 9. Identify grid-integration and off-grid opportunities to support energization and increase public fleet resiliency

FIGURE 12: MDHD ZEV ADOPTION STRATEGIES

Strategy A: Jumpstart the ZEV Transition for Small- and Medium-Sized Fleets

Ensure no one is left behind by supporting small- and medium-sized fleet transitions with technical and financial supports.

ACTIONS

- Increase Access to ZEV Technical Assistance and Education for Small- and Medium-sized Fleets
- Encourage Shared EVSE with Small Fleet Operators
- Advance Small- and Medium-Sized Fleet Charging Pilot Projects

Increase Access to ZEV Education and Technical Assistance for Small- and Medium-sized Fleets

Action Lead(s)	Supporting Department(s)
SF Environment	OEWD

Tasks	Timeline
Launch a local Fleet Engagement and Technical Assistance program for small- and medium-sized fleets	Near-Term
Engage community-based organizations (CBOs) in robust outreach to hard-to-reach fleets	Near-Term

CONTEXT

Small- and medium-sized fleet operators (fewer than 50 vehicles) are not required to comply with CARB's ACF rules. ZEV adoption is voluntary for these fleets, which experience unique challenges to transitioning to ZEVs, including slim profit margins, poor cash flow, and limited staff time and upfront funds to access and take advantage of available vehicle incentive/rebate programs. Small- and medium-sized fleet operators must also navigate a fragmented landscape of changing vehicle technologies, new operational and governance considerations around charging infrastructure, and evolving funding opportunities, often with fewer resources than larger competitors.

To meet the City's goals of net-zero emissions by 2040, all fleets in San Francisco will need to decarbonize. Easy-to-access technical assistance can support fleets through education on the benefits and process of electrification as well as support for accessing grants and financing incentives.

Cal Fleet Advisor, a CEC-funded program funded run by the nonprofit CALSTART, is one existing technical advisory service that is available to all small- and medium-sized fleets in California and could be a benefit to San Francisco-based fleets. Cal Fleet Advisor provides personal guidance to help fleets evaluate their needs, navigate barriers that may prevent them from incorporating ZEVs into their operations, and connect with available vehicle incentives. At the same time, Cal Fleet Advisor is unable to offer grant writing or other grant-related technical assistance.

BARRIERS

From direct implementation experience of the Air District's diesel engine retrofit program, the City observed that it is difficult to reach small fleets because of participation barriers such as lack of staff, time, money, and awareness of program offerings and benefits. Conversations with TAC members and other City staff currently engaging with local truck drivers have also highlighted the importance of in-person, face-to-face engagement as an effective approach to reach small fleets in underserved communities given how fleet operators and drivers are spread out, have long and/or irregular hours, and may be part of various immigrant communities. During initial conversations with

The SF Market, the SF-Marin Food Bank, and other small fleets, SF Environment learned that many small fleets do not know about Cal Fleet Advisor, which could be improved with proactive and targeted outreach to hard-to-reach fleets in collaboration with local partners.

TASKS

To help small- and medium-sized fleets transition their MDHD vehicles to ZEVs, SF Environment will launch a Fleet Engagement and Technical Assistance program to assist these fleet operators in navigating institutional and economic barriers to electrification. with transitioning their MDHD fleet to ZEVs. This local effort will work with community-based organizations to identify hard-to-reach small- and medium-sized fleets, build relationships with these fleet operators for ongoing support from the City and to support a peer knowledge-sharing network, and facilitate fleet connections with support pathways such as Cal Fleet Advisors and/or additional technical consultant support to provide the full suite of support for their transition. The City has funding allotted to launch this outreach effort in 2025, but will require additional funding to ensure ongoing targeted outreach and technical support for fleets.

To ensure broad outreach as well as specific outreach to hard-to-reach fleets, SF Environment will develop an informational package for fleet operators outlining available incentives and technical assistance to be disseminated where fleet operators interact with City agencies including SF Planning, OEWD and the Office of Small Business as well as at well-known CBOs including the SF Chamber of Commerce. SF Environment and partners will engage in on-the-ground, in-language canvassing and connect with trade unions, trucking associations, and other business and community partners as pathways for targeted outreach.

A targeted, wrap-around educational, assistance, and coaching program will assist small- and medium-sized fleet operators.

EDUCATING FLEET OPERATORS ON AVAILABLE MODELS AND ASSISTING WITH VEHICLE SELECTION

Many fleet operators have questions about the reliability of ZEVs, which can discourage their adoption. This pilot technical assistance program would actively reach out to and educate small-fleet operators about the diverse range of ZEV models – such as via ride-and-drive events and technical workshops – and engage in in-depth discussions with operators about the specifications, features, and practical applications of different ZEVs in their specific industry. These workshops can include “mythbusting” that is specific to MDHD vehicles and San Francisco, such as clarifying the relative risk of severe weather or wildfire impacts on the local electrical grid and connecting fleet operators just starting their journey with those further along so that they can share their experience using specific vehicle models. During the TAC meetings, for example, members shared experiences where advertised ZEV ranges were unreliable for specific models, and others followed up with suggestions on other models that have worked well.

Additionally, expert guidance could be provided to assist operators in selecting the most suitable vehicles for their fleet and business needs, considering factors such as the fleet vehicles’ duty cycles (e.g., daily mileage and routes), operational patterns, replacement schedules, domicile location(s), and performance requirements (e.g., whether there is refrigeration, frequent idling, steep streets on typical routes, weight of heaviest load carried, etc.) and the associated available ZEV models’ payload capacity, range, and charging compatibility.

ASSISTING OPERATORS IN PLANNING FOR CHARGING/REFUELING AND MAINTENANCE NEEDS

A pilot assistance program could help assess the unique requirements of each fleet operator enrolled in the program and develop tailored strategies to integrate ZEV charging/refueling and maintenance into their operations. This includes investigating the potential ownership and governance models available for both the vehicles and infrastructure – e.g., considering direct ownership, leasing, and/or "charging as a service" models – and evaluating optimal charging/fueling speeds, number of ports, and locations, considering factors such as vehicle operational requirements; available space as compared to the wheelbase of the fleet vehicles to confirm whether drive-through chargers will work or if there is space to turn or backup; and location accessibility, availability, convenience for drivers, maintenance, and/or facilities staff. Operators could be guided on developing charging schedules that minimize downtime and maximize vehicle availability while also avoiding concurrent charging with peak utility pricing where possible, and/or consider the use of battery backups to use off-grid power when prices are high, ensuring a smooth and cost-effective transition to ZEVs. This step could also include an assessment of how labor costs will shift if the new charging/fueling strategy requires charging off-site or a need to move vehicles around.

DETERMINING INFRASTRUCTURE AND ELECTRICAL CAPACITY NEEDS FOR VEHICLE CHARGER INSTALLATION

A technical assistance program could involve site assessments to determine the most suitable locations for charging/fueling installations, evaluating site power capacity to determine if any electrical upgrades are needed to prevent overloading existing systems and/or disrupting current operations, and if so, what additional costs or timelines should be incorporated into planning. This step would require coordination with PG&E, SFPUC, and/or a contractor to assess the power available for on-site equipment. Furthermore, the program can connect fleet and/or facility operators to building electrification resources and programs – including those managed by SF Environment – to consider broader electrification needs at the site.

ESTIMATING TOTAL COST OF OWNERSHIP AND THE UPFRONT AND ONGOING BUDGET REQUIREMENTS FOR ZEV ADOPTION

INFORMING FLEET OPERATORS ABOUT AVAILABLE FEDERAL, STATE, LOCAL, AND UTILITY GRANTS AND FINANCIAL RESOURCES AND ASSISTING WITH ACCESSING THESE OPPORTUNITIES

SF Environment has had conversations with nonprofits who have indicated a need for additional guidance and direct support with grant writing and proposal development. A technical assistance program could alleviate this burden by informing fleet operators about the array of grants and financial resources available and potentially assisting with applications. Operators would be coached on the tax incentives and financing options available through federal, state, local and utility grants designed to subsidize the conversion of fleets to ZEVs. Assistance could be provided to fleet operators to project manage, draft, and/or submit grant applications.

A local technical assistance program that offers step-by-step guidance would alleviate the burden for small businesses and nonprofits in navigating the complexities of both fleet electrification and grant writing. This program could also help determine whether small fleets in San Francisco require additional gap financing to transition to a ZEV fleet.

Funding would be used to solicit consultant(s)/partner(s), conduct outreach to fleets, recruit a pilot cohort that will receive tailored technical assistance, and seek funding for a ZEV adoption and/or charging/fueling project with one or more of cohort participants.

Encourage Shared EVSE with Small Fleet Operators

Action Lead(s)	Supporting Department(s)
SF Environment	

Tasks	Timeline
Explore opportunity to use City property for shared use charging	Near-Term
Conduct outreach to connect with relevant shared charging partners	Medium-Term
Identify potential for policy solutions to incentivize shared charging projects	Long-Term

CONTEXT

Large private and public landowners, such as major retailers and fleet operators, have considerable land holdings within San Francisco where EVSE can be installed. Many EV charging network providers already occupy popular retail establishments throughout San Francisco; namely, shopping malls and grocery stores, although at present these locations serve light-duty vehicles rather than MDHD vehicles. Drivers' length of stay and the prevalence of surface parking for these land uses can make these locations convenient for many EV charging network providers and their customers.

There is an opportunity for strategic deployment of charging assets that multiple small or large fleet operators could access. For example, grocery retailers in the city with large parking lots may partner with third party EV charging network providers to deploy charging stations for their customers to use during the day, using their large properties as host sites for this infrastructure. However, the chargers may have low utilization in off-peak periods, such as overnight, presenting an opportunity for nearby, small fleet operators to leverage these stations to charge their fleet vehicles overnight. Small fleet operators often lack the real estate to install EVSE, making them a potentially eager customer base if MDHD EVSE were to be publicly available in shared locations.

One key outcome of co-sharing charging assets is to provide greater access to EVSE and higher utilization of assets. For owners of MDHD vehicles, this would allow for more opportunities to charge vehicles near their domiciled locations and enable greater returns on EVSE investment with higher utilization rates. Widespread deployment of EVSE also increases charging convenience and enables more equitable adoption of ZEVs. Landowners who deploy assets for co-sharing would have a greater expected return on their investments as a result of expanding the customer base and increased utilization of stations.

BARRIERS

The size of many MDHD vehicles is a key consideration, given that most lots and garages are sized for passenger cars (e.g., vertical clearance, stall size, and aisle width). The design of public parking spaces that accommodate both cars and trucks will need to be designed to allow trucks to back out safely or be designed as drive-through spaces that don't require backing. Additional obstacles may

include a lack of security; suitable pavement infrastructure; user-friendly reservation systems and payment software; added labor costs for moving vehicles; and long-term, domicile vehicle parking (i.e., access to private lots for charging may not be a viable long-term solution for some fleet owners). Convening property owners and EV charging network companies as well as fleets will be required to successful deployment and may present obstacles with respect to easements, institutional capacity, branding, etc.

TASKS

SF Environment will conduct outreach and education to property owners and fleets via touchpoints where they interact with City government agencies (e.g., SF Planning, OEWD, Office of Small Business, SF Chamber, etc.) to educate them on the potential benefits of shared charging infrastructure, including revenue generation and shared costs for fleets.

SF Environment will also leverage the City's EV Ombudsperson program to connect with property owners exploring public charging projects and to leverage a public charging investment mapping tool being developed in coordination with academic partners,[9] which the department will use in tandem with the MDHD Charging Suitability Mapping Tool to gather community and industry input on target or planned charging sites and support matchmaking.

SF Environment will also explore developing policy solutions to facilitate shared charging, such as incentives (e.g., tax abatement, expedited land use processes) for shared charging uses, as well as work with OEWD to investigate the potential for shared fleet charging projects to be included in the community benefits process for development projects.

Finally, the City of San Francisco owns and maintains several properties across the city. As SF Environment and Central Shops explore both public and private charging projects across various parking facilities, it can review properties to consider whether they could public or shared-private charging with private small- and medium-sized fleets.

[9] The EV Equity Roadmap tool is a free mapping tool to inform equity-oriented site selection for EV and e-mobility infrastructure investments. It enables local agencies, partners, and developers to engage in discussions about high-priority sites for investment, using a novel approach to integrate locally relevant infrastructure and equity geospatial data layers. *Please note the tool is currently a beta version still under development, available for over 20 California counties, with more being added on a regular basis alongside performance and interface improvements.*

Advance Small- and Medium-Sized Fleet Charging Pilot Projects

Action Lead(s)	Supporting Department(s)
SF Environment/Port of San Francisco	

Tasks	Timeline
Charging Pilot at The SF Market for Medium-Duty Vehicles	Medium-term
Charging Pilot at Pier 96 with The Port of San Francisco for Heavy-Duty Vehicles	Long-term

CONTEXT

To support small- and medium-sized fleets, this Blueprint identifies two pilot charging projects aimed to serve specific cohorts of small- and medium-sized fleets. SF Environment worked with Arup, a planning and design firm, to review MDHD vehicle registration, traffic, and local electrical capacity data and findings from outreach and engagement with City fleet managers, small- and medium-sized fleet operators, and residents living in Bayview-Hunter's Point and southeast San Francisco to review the types of pilot projects that the City is in the best position to advance. Figure 13 below outlines the site selection criteria framework used to determine that a publicly accessible charging hub on public (i.e., City-owned) property presents the highest pilot site opportunity.

Location	Off-street				On-street
Owner	Private *Individual, business, or EV network provider*		Public *Public property, funded and/or managed publicly*		Public *Public property, funded and/or managed publicly*
Charger Access	Privately accessible only (e.g. business owners' vehicles)	Publicly accessible at private lot or garage	Public charging hub	Distributed chargers (e.g. library, civic center)	Curbside
Primary Barriers	• High costs and permitting challenges • Potential grid upgrades • Access to funding and technical resources	• High costs and permitting challenges • Potential grid upgrades • Some sites may not be sized for MD/HD vehicles	• Large site availability • Permitting time and costs • Potential grid upgrades • Ensuring hub meets all users' varied needs • Concentrated power availability	• Widespread site availability • Many individual permits required • Management of distributed chargers is more challenging	• Permitting time and costs • Enforcement effort required • High costs if not deployed on existing utility infrastructure • Access concerns for trucks
Support From City Department	Provide access to educational resources such a point of contact for all charging related questions (funding, permitting, etc.)	Provide access to educational resources such a point of contact for all charging related questions (funding, permitting, etc.)	• Lead engagement with businesses and operators • Work with other departments to manage the deployment of the charging hub	• Lead engagement with businesses and operators • Work with other departments to ensure consistency in deployment between sites	Work with other departments to ensure consistency in deployment and suitability to MD/HD vehicles in areas with high truck traffic
Pilot Site Opportunity	Opportunity to influence, but not part of SFE-led pilot	Opportunity to influence, but not part of SFE-led pilot	High	Moderate	Opportunity to influence, but not part of SFE-led pilot

Anticipated lowest barrier pilot site type

FIGURE 13: PILOT SITE SELECTION CRITERIA FRAMEWORK

SF Environment worked with TAC members and other City agencies to review potential City-owned sites that could serve small- and medium-sized businesses with either a fully public or shared-

private MDHD fleet charging project. Two sites were identified – The SF Produce Market and Pier 96. Existing tenants and operators using these sites – many of whom are small- and medium-sized fleets, independent truck owner/operators, and community partners and nonprofits – are seeking resources and shared infrastructure to support their decarbonization efforts. The City can streamline institutional barriers and provide financing support to install dedicated depot or shared charging at these sites.

Detailed innovation and pilot implementation reports, along with a funding matrix, can be found in Appendix C.

SHARED CHARGING AT THE SF MARKET

The SF Market, San Francisco's wholesale produce market located in Southeast San Francisco, is an ideal location for a MDHD ZEV charging pilot. Located in one of the City's designated Environmental Justice Communities, The SF Market is home to 18 unique Market merchants across six buildings and additional food businesses that purchase fresh produce from hundreds of regional farms and growers each year. The SF Market has approximately 156 MDHD merchant fleet vehicles moving through the site each day that distribute produce to thousands of entities throughout the Bay Area. Additionally, CBOs across the Bay Area collect more than 1 million lbs. of food donations from Market merchants annually to distribute to food recovery organizations. CBOs increasingly use EV box trucks for food recovery, and many of the nearly 500 Market employees use EVs to drive to work.

The SF Market fleets vary in size, only two of which are covered by CARB's ACF regulations. Market merchants operate MD/HD vehicles ranging from Class 4 step vans to Class 7 straight trucks, many of which domicile on site. Some merchant vehicles travel up to 200 miles per day, from Fresno to San Francisco. Others are used primarily for last-mile/urban delivery between The Market and wholesalers or grocery stores in San Francisco, traveling 5 to 20 miles per day. Each of these merchant fleets have their own unique needs and concerns. The SF Market does not yet have EV charging infrastructure on site for any of these users.

PROJECT PROGRESS-TO-DATE AND GOALS

SF Environment and The SF Market engaged in early 2024 on a federal grant opportunity through the DOE's Vehicle Technology Office to pilot a shared MDHD ZEV multi-use charging model for small fleets, CBOs, and the public on site at The SF Market. During the collaborative proposal development process, it became clear that The SF Market did not yet have three key readiness components that would have enabled them to launch a pilot: clear participation from fleet merchants, a designated location on the Market to place the chargers, and an understanding of electrical capacity to support charging infrastructure. The team abandoned the grant opportunity and, driven by the dual needs of providing the necessary EV infrastructure for their produce businesses to make the ZEV transition and achieving readiness to be competitive for funding support, The SF Market focused on understanding the near- and medium-term scope of work needed for fleet electrification, placing Market merchants' needs at the center.

Building off this learning, The SF Market, with the support of SF Environment, dedicated time to understanding the EV landscape and their position in it, as well as the orbit of strategic and technical assistance that exists to assist organizations in EV planning. The outcome of these learnings culminated in the Market hosting an EV Truck and Forklift Education Workshop specifically designed

for their Merchants. Industry experts from CARB, BAAQMD, and Cal Fleet Advisors participated in the workshop to explain upcoming environmental regulations that will impact merchant vehicles and share resources available to help make vehicle transitions more cost effective. Five Market businesses participated in the workshop. The event was also intended to help The SF Market staff better understand potential future changes in power demand across the Market due to the infrastructure needed to support electric vehicles. The SF Market now has three actionable next steps they are working on to support fleet electrification on the Market in the next 12-18 months.

ACTIONABLE STEPS

- As a result of the workshop, The SF Market clearly identified three merchants with significant interest in acquiring at least one EV in the next 1-3 years. Within this period The SF Market will work alongside the merchants to identify a clear path to support their charging needs and develop an actionable plan to plug in. As part of this step, The SF market will collaborate with SF Environment to identify opportunities to implement a charging pilot.
- The SF Market plans to incorporate EV infrastructure into its Reinvestment Project to modernize and expand the existing campus and meet the demand of the growing Bay Area Food Economy. The initial focus will be on the redevelopment of one of their warehouses located at 1900 Kirkwood Avenue, with the intent of incorporating EV requirements into the design and permitting process to install basic infrastructure to support EV charging for future merchants.
- The SF Market plans to seek funding to hire a consultant to build out a 5-year EV master plan for The Market. The master plan is intended to be actionable and will include an evaluation for market tenants to replace their ICE vehicles with EVs as well as consider both private and shared-private charging models.

SF Environment and The SF Market continue to communicate around the progress The Market is making to develop their near- and medium-term ZEV scope of work and to implement a pilot that addresses near-term merchant needs.

The primary goal of a collaborative pilot with The SF Market is to identify the technical requirements, challenges and barriers, resource needs, impacts, and optimal ownership and governance models for MDHD ZEV charging for multiple fleets operating at one site, which could be replicated at other sites in San Francisco and California.

THE PILOT PROJECT ACTIONS

- Installing MDHD EV chargers at The SF Market distribution hub in the Bayview-Hunters Point neighborhood.
- Identifying and testing the feasibility and sustainability of charging models that The SF Market and Market merchant fleets prioritize, and collaborating with The SF Market on small fleet outreach.
- Identifying installation and permitting process challenges; sustainable business, access, and pricing models for operations and cost recovery; and ongoing maintenance and safety needs that can provide both The SF Market and the City with the framework for a MDHD charging model that can be replicated in other urban logistics hubs.

PROJECT APPROACH AND INNOVATION

This pilot provides The Market and the City with critical information on the entire process of installing, monitoring, and reporting on MDHD EV charging in a shared fleet environment, including: identifying a charging technology provider; engaging with multiple small fleet vendors; selecting site(s) on The SF Market campus; identifying site needs; completing permitting, utility interconnection and installation; collecting usage data; surveying user experience; and building a business model for long-term sustainability of the infrastructure operations and maintenance (O&M).

The unique innovation to be tested by this pilot is advancing charging at a “campus-style” site that includes a variety of MDHD users With many Market merchant fleets operating overnight and likely charging during the day, there may also be potential to share the charging infrastructure with off-road Market equipment, community partners or the public. The SF Market will learn how to manage and prioritize charging access; set rules and regulations for charging during and after Market hours, as well as overnight; implement a maintenance and safety plan; and identify a simple, affordable, and accessible payment mechanism for users (like tap-to-charge). Since the City’s long-term goal is for all merchants fleet, including The SF Market fleets, to be able to benefit from adoption of ZEVs, and utilize the chargers, developing and testing a cost/revenue sharing model that can scale is a key component of the pilot. Beginning with a small pilot (e.g., 2-4 Level 2 or DC fast chargers depending on vehicle class and duty cycle of participating fleets) enables The SF Market to expand and test additional charging as demand grows.

POTENTIAL IMPACT

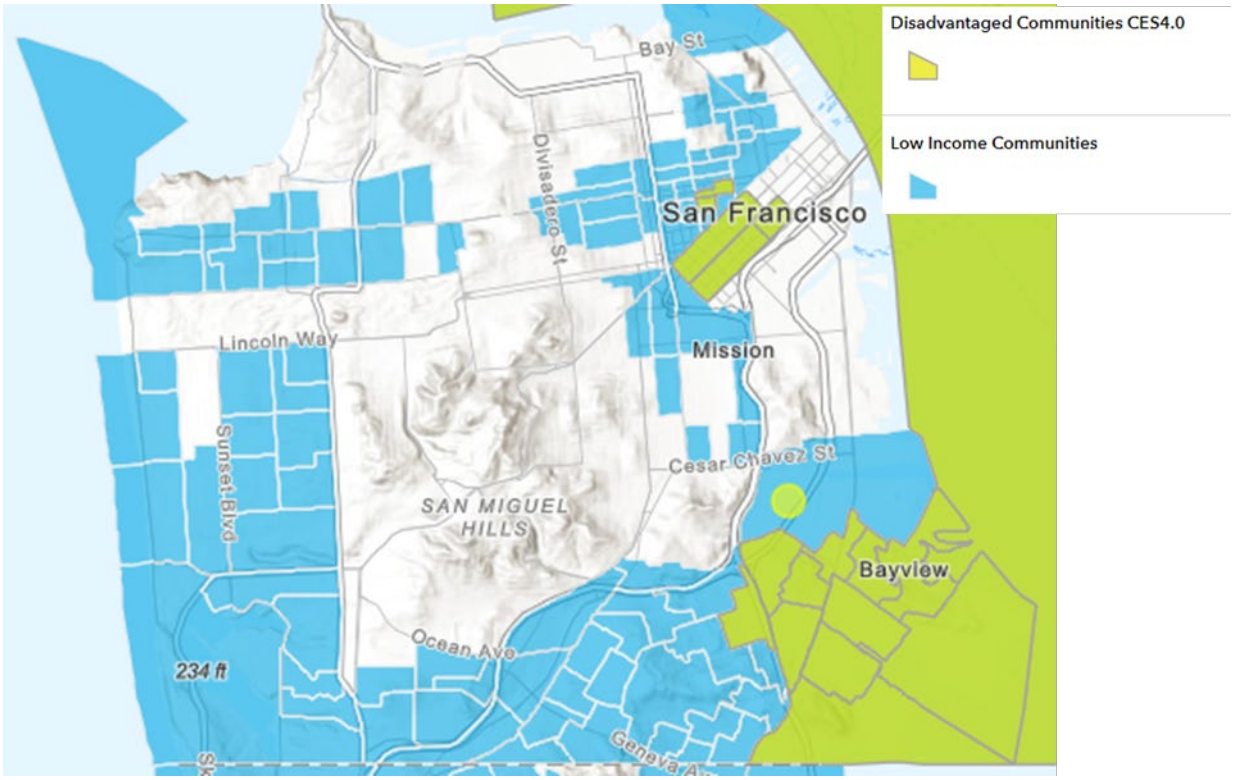

FIGURE 14: THE SF MARKET IN RELATION TO DISADVANTAGED AND LOW-INCOME COMMUNITIES

In San Francisco, a considerable number of commercial and industrial warehouses are situated in or close to Disadvantaged Communities (DACs) and Low-Income Communities (LICs). These areas have elevated pollution ratings due in part to heavy MDHD traffic. Historical zoning patterns and the proximity to freeways have led to the concentration of many such businesses within DACs. The SF Market sits in the Bayview-Hunters Point District of San Francisco. In Figure 14 above, The SF Market is indicated using a green dot on CARB's Priority Populations Map, which identifies Disadvantaged and Low-Income Communities.[xxxvi] By piloting a demonstration project in this area of San Francisco, SF Environment can accelerate MDHD ZEV adoption and significantly reduce GHG and criteria air pollutant emissions to the benefit of workers and residents in the neighboring Bayview-Hunters Point Community. The addition of accessible charging at The SF Market will support the transition of 156 heavy-polluting MDHD vehicles currently moving through the site each day to ZEV. With an average merchant truck traveling 100 miles per day, long-term GHG emissions reductions of electrifying these vehicles is estimated to be 8,900 tons annually.[10]

[10] Calculations from https://fleets.pge.com/fuel-savings

PIER 96 CLEAN TRUCKING INITIATIVE

The Port of San Francisco supports several types of diverse cargo. Industrial cargo is concentrated in the Port's Eco-Industrial area located in the southern waterfront. At Pier 80, automobiles are imported and exported. At the Pier 92 and Pier 94 terminals, dry bulk cargoes are imported and processed to support most large-scale construction projects in the city. Pier 96 includes processing of recycled materials for the entire city and parking for the trucking community (*Figure 15: View of Trucks Parked on Pier 96*). Adjacent rail services support the construction industry, as well, including the export of contaminated soils.

FIGURE 15: VIEW OF TRUCKS PARKED ON PIER 96

Essential to these cargo activities is the local trucking community, using primarily heavy-duty, Class 7 and 8 vehicles, that links the vessel and rail services to the rest of the city. Some trucks are owned and operated by Port tenants such as importers of aggregate, concrete batch plants, and a rendering plant. Others are run by smaller trucking companies, and many are owned and operated by individuals, most of whom live in the surrounding community. The Port has always recognized this trucking community as a lynchpin to the goods movement in San Francisco and has supported these operators by providing land for parking, mostly at Pier 96. Providing zero-emission charging and/or fueling infrastructure at Pier 96 can support operational certainty to these small truck owner/operators as they consider the costs and benefits to electrification. With 67% of all Class 7-8

vehicles subject to ACF regulations including all drayage trucks, this will be a timely effort with significant benefits for the industry and the community. Zero-emission Class 8 trucks are commercially available with driving ranges that support the local truck routes of most Port cargo trucking.

PROJECT GOALS

The Port is currently undertaking a Clean Trucking Initiative which aims to bring clean fuel sources to Pier 96 to support the trucking community in the transition to ZEVs. The Port has identified Pier 96, a 50-acre site and current home to more than 100 trucks, as the most promising location. In addition to hosting trucks onsite, Pier 96 is located in the Bayview-Hunters Point neighborhood, an area with a high concentration of industrial uses and MDHD vehicles, making it a good candidate for incorporating publicly accessible refueling. There are over 2,800 registered MDHD vehicles in zip code 94124, which encompasses Pier 96 and Bayview-Hunters Point (*Figure 16: Pier 96 in Relation to Disadvantaged and Low-Income Communities*).[xxxvii] Pier 96 is also within close proximity of two highways, Interstate 280 and Highway 101, with heavy truck traffic. In 2022, The Interstate 280 exit closest to Pier 96 had an annual average daily truck traffic count of 2,325 and the Highway 101 exit closest to Pier 96 had an average daily truck traffic count of 8,094.[xxxviii] Public charging and refueling could help serve vehicles domiciled in the surrounding areas and can provide a refueling point for trucks traveling on longer journeys.

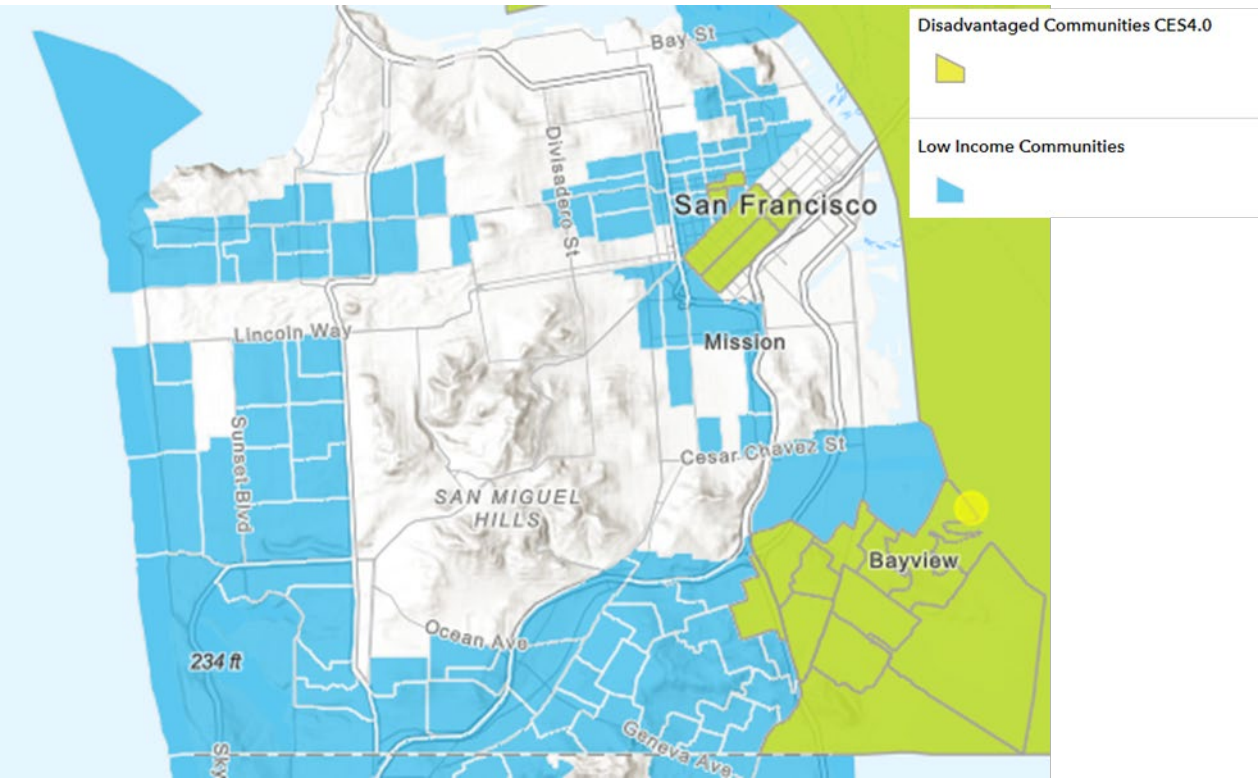

FIGURE 16: PIER 96 IN RELATION TO DISADVANTAGED AND LOW-INCOME COMMUNITIES

The primary project goals for this effort are:

- Engage the local trucking community in a community resource assessment

- Conduct a technical assessment of the viability of Class 8 battery electric and hydrogen fuel cell ZEVs
- Estimate the electrical load of three design scenarios that consider battery electric charging and/or on-site production of hydrogen fuel
- Evaluate the feasibility of installing necessary infrastructure to support each of the three design scenarios
- Develop conceptual plans and cost estimates for each design scenario

PROJECT APPROACH AND INNOVATION

The Port is in the early stages of planning this project, which requires a broad assessment of Pier 96's location and infrastructure. Part of the Port's planning effort includes a community resource assessment, an assessment of the current Class 8 truck technologies, and a site and infrastructure feasibility assessment.

The community resource assessment will gather information on existing perspectives that truck operators have towards ZEV technology. Community insight from Pier 96 tenants and the neighboring trucking community will help the Port understand the gaps that prevent these operators from transitioning to ZEVs. ZEV education and outreach focused at Pier 96 could include educational workshops, ZEV truck purchasing and incentive guidance, and a ride and drive to familiarize the local trucking community with ZEV vehicles and resources.

The technological assessment will consider ZEV truck performance, including vehicle range, refueling times, gross vehicle ratings, commercial availability, and lifecycle cost. The assessment will determine the infrastructure needed for the particular duty cycles and use cases for the Port tenants and local trucking companies that domicile at Pier 96.

Port electricity is sourced from hydroelectricity and is, therefore, zero-emission. The Port is interested in understanding the possibility of using electricity to support EV charging stations and/or powering an electrolyzer that could produce zero-emission hydrogen for use in fuel cells. The site and infrastructure assessment will evaluate the feasibility of installing necessary infrastructure to support three design scenarios that include EV charging stations and/or hydrogen refueling. This assessment will also consider the cost of enhanced electrification and the best configurations for parking and refueling operations.

The outcome of this assessment will help guide the Port's decisions regarding future infrastructure investment at Pier 96.

Planning should take an estimated twelve months to complete, starting January 2025. Depending on the results of the assessment, the Port anticipates it will then look to secure funding for installing charging and/or refueling infrastructure based on the needs identified during the planning phase.

POTENTIAL IMPACT

SF Port does not have any charging or fueling infrastructure dedicated to MDHD ZEVs for its hosted trucks, and Bayview-Hunters Point has a lack of public charging infrastructure overall. The addition of affordable and accessible charging at Pier 96 could accelerate electrification of the roughly 100 heavy-duty vehicles currently parked at the site each day, reducing annual GHG emissions by nearly 6,000 tons per year, assuming these vehicles travel roughly 50 miles per day.[xxxix] At the same time, a

publicly accessible, shared charging site could support the thousands of MDHD vehicles that domicile in the vicinity of Pier 96.

Additionally, if a clean hydrogen electrolyzer is deemed appropriate, a public charging location with a hydrogen component could expand Northern California's role as a national hydrogen hub. The addition of an electrolyzer would be especially valuable for Class 8, heavy-duty vehicles, given performance requirements and the challenge of longer charging times for larger battery electric trucks.

Through this Clean Trucking Initiative, the City can potentially increase the pace of MDHD ZEV adoption and significantly reduce GHG and criteria air pollutant emissions to the benefit of workers and residents in the neighboring Bayview-Hunters Point Community.

Strategy B: Strengthen the MDHD ZEV Ecosystem

Work with public and private entities to ensure readiness throughout the city to accommodate MDHD ZEV for all fleets.

ACTIONS

- Coordinate Fleet Operators to Streamline Grid Upgrades
- Develop a Skilled Workforce to Support the MDHD ZEV Transition
- Develop Land Use Laws to Encourage the Installation of ZEV Charging Infrastructure
- Develop microhubs to Shift Last-Mile Deliveries from Medium-Duty Vehicles

Coordinate Fleet Operators to Streamline Grid Upgrades

Action Lead(s)	Supporting Department(s)
SF Environment	SFPUC

Tasks	Timeline
Support the development of the regional MDHD ZEV Roadmap	Near-Term
Engage PG&E and SFPUC to determine challenges and opportunities for coordinating grid upgrades	Medium-Term
Engage local fleets to determine timelines for transitioning to ZEVs	Medium-Term
Encourage utilities to combine Integrated Resource Planning and Distribution System Planning processes	Long-Term

CONTEXT

As MDHD fleets transition to EVs and add new load to the utility grid, demand on the grid will require infrastructure upgrades. Coordinating fleet operators for EV charging infrastructure rollout can offer several benefits to both the operators and the utilities responsible for the grid. Sharing information on charging locations and needs can help avoid unnecessary individual upgrades and potentially lead to cost-sharing opportunities. A coordinated approach also allows for better planning of charging infrastructure deployment and potential opportunities to “dig once” by aligning construction timelines and avoiding installations in congested areas that may trigger oversized upgrade costs. Operators can leverage collective data to identify optimal charging locations that minimize grid strain and potentially reduce wait times for permitting and interconnection.

For utilities, understanding the collective charging demands of multiple fleets helps them pinpoint areas requiring grid upgrades and prioritize investments. This avoids costly over- or under-building of grid capacity. While there are currently intake processes for customers pursuing fleet electrification (e.g., PG&E’s EV Fleet program), proactive coordination between fleets within the same neighborhoods can avoid staggered projects that may lead to less cost-effective grid upgrades, or even uncover opportunities to share infrastructure.

BARRIERS

Coordinating private fleet operators will be challenging. Some operators might be hesitant to share data on fleet size, routes, and charging needs, fearing it could reveal sensitive information to competitors. Also, many organizations have not yet determined their fleet needs, making it more difficult for them to coordinate with others further along in the planning process.

Determining how to equitably share the costs of grid upgrades amongst various fleet operators could be complicated. A program structure that effectively balances the needs of diverse fleets and

utilities will require careful design and ongoing management. A third-party entity would likely need to be involved to build trust and encourage collaboration between potentially competing entities to ensure all parties feel that their interests are being considered fairly. Given SF Environment's experience with outreach for the development of this Blueprint, proactively building relationships with fleet operators is critical to ensure long-term collaboration.

TASKS

SF Environment will engage with small- and medium-sized fleets in two ways. First, directly through its relationships with The SF Market and the Port of San Francisco, the partners identified for the MDHD shared charging pilots described in this Blueprint. Secondly, through the launch of a Fleet Engagement and Technical Assistance program outlined in Strategy A. This early and ongoing engagement of fleets will enable SF Environment to learn more about their ZEV transition timelines while also providing transition support with planning and incentive/financial resource information. Currently, the City has set aside resources from the City's Carbon Fund to support this effort which will launch in 2025. Through this work, SF Environment will begin to track ZEV transition timelines, local fleet domicile locations, and planned electrification projects.

In parallel, SF Environment will regularly engage with PG&E and SFPUC to share available project pipeline information, including fleet ZEV transition requirements and timelines, to help determine challenges and opportunities for coordinating distribution grid upgrades and supporting efficiencies, as well as improving the accuracy of electrical capacity demand estimates for new charging infrastructure.

To support MDHD adoption at the regional level, SF Environment is partnering with the Rocky Mountain Institute (RMI) to develop a regional plan for estimating the charging infrastructure needed for full electrification of trucking in the Bay Area. RMI has been contracted by the US Department of Energy DOE, and SF Environment will share data and findings from this Blueprint, coordinate outreach and listening sessions to gather relevant information for RMI's regional plan, and participate on RMI's project advisory committee. SF Environment intends to work with RMI to further investigate the potential for regional coordination of fleets to streamline grid upgrades. This collaborative effort launched in early 2024 and is slated for completion in late 2025.

In the long term, SF Environment will advocate both locally and with the California Public Utilities Commission to encourage utilities to combine their Integrated Resource Planning and Distribution System Planning processes so that large electrification projects – including MDHD fleet charging hubs – can inform both generation and infrastructure planning processes.

Develop a Skilled Workforce to Support the MDHD ZEV Transition

Action Lead(s)	Supporting Department(s)
Office of Economic and Workforce Development (OEWD)	City College of San Francisco, SF Environment, ADM – Central Shops

Tasks	Timeline
Work with City College of San Francisco to provide training on MDHD ZEVs	Near-Term
Increase enrollment in MDHD ZEV training programs and EVITP certification among San Francisco electricians through targeted outreach	Medium-Term
Support development of processes and policies for MDHD ZEV training for municipal fleet operators and local procurement for vehicle and charging maintenance	Long-Term

CONTEXT

Transitioning to ZEVs requires a workforce with new skills in areas such as EV maintenance and charging infrastructure installation and operations. This is especially true for MDHD ZEVs which have different technical requirements compared to light-duty vehicles.

While the typical MDHD ZEV will require less maintenance than an ICE vehicle, there are other aspects of the transition that will require specialized skills and training, including understanding the mechanics and electronics of battery or fuel cell electric vehicles, knowledge of safety protocol for high-capacity batteries and maintenance following an accident, training on handling and maintaining fuel cell systems for hydrogen powered vehicles, skills for installing and maintaining high-power charging stations suitable for large vehicles, and training on best practices for charging/fueling and fleet management according to the vehicle's duty cycle and battery or fuel cell specifications.

In addition to these skills, all EV charging stations funded or authorized by the California Public Utilities Commission (CPUC), the CEC, or the state board, must be installed by a licensed contractor. At least one electrician on each installation must hold an Electric Vehicle Infrastructure Training Program (EVITP) certification. Workforce development programs can provide the necessary training and certification for workers to meet these needs.

Workforce development projects can be specifically aimed at low-income communities which can bring about multiple benefits by improving economic outcomes for communities that have historically been under-resourced, while also helping to educate low-income community members about the financial and environmental benefits of electric transportation. SF Environment currently collaborates with CBOs on outreach in DACs. There is an opportunity to leverage these existing pathways to recruit and educate workers for EVITP and potential MDHD ZEV training and certification programs.

The City College of San Francisco, San Francisco's community college, currently has an automotive training program that has strong partnerships with San Francisco dealerships, independent shops, and automotive startups. This program offers an Automotive Hybrid and EV Technology Certificate that could provide the foundation for a connected MDHD ZEV-specific training curriculum.

BARRIERS

The current workforce ecosystem has limits and challenges that could prohibit ZEV adoption in San Francisco.

Many people from communities targeted for inclusion in workforce development have existing financial hardships that may make switching to a new industry or career with high-wage potential logistically infeasible. MDHD ZEV training and education programs will need to provide the resources that hard-to-reach audiences – including people with limited English proficiency, people with criminal histories, people with children, and people with low incomes – need in order to participate.

Along with a shortage of workers, there is also a shortage of qualified educators and programs that support people as they develop new ZEV skills. The workforce required for the EV and infrastructure industry has diverse occupations with unique skill sets; therefore, curriculums must be specialized by occupational classification.

TASKS

Inclusive workforce development must include collaboration with community colleges, partnering with local CBOs, and collaborating with labor unions.

With support from SF Environment, and pending funding, San Francisco's Office of Economic and Workforce Development (OEWD) will expand existing apprenticeship and workforce programs to recruit and train workers to fill roles in ZEV-related jobs, including MDHD ZEV mechanics, and EVITP-certified electricians for the installation of charging infrastructure. Currently, City College of San Francisco (CCSF) works in collaboration with OEWD on several workforce training programs for residents, including the pre-apprenticeship CityBuild program for construction administration, and pre-apprenticeship programs with Local Union 1414 for automotive machinists, mechanics, and electrical to place apprentices from these programs in City positions with key departments. CCSF's existing automotive training program offers a Certificate of completion for Automotive Hybrid and EV Technology. SF Environment, in collaboration with OEWD and CCSF, will expand the existing EV automotive training certification programs to include learning and certification of completion opportunities for MDHD ZEV mechanics, machinists, and electrical.

In addition to Local Union 1414, OEWD, CCSF and SF Environment will engage labor unions and other electrician trade networks to collaborate on ways unions can support their members as they prepare to enter into the ZEV workforce. CCSF currently manages the apprenticeship programs for City positions including automotive, CityBuild, Police and Fire Academies, and pending funding, will investigate the costs and needs for expansion of the automotive apprenticeship program to include MDHD and MDHD ZEV.

To support enrollment in these programs, OEWD and SF Environment will collaborate with CBOs to provide outreach to San Francisco's hard-to-reach and economically disadvantaged communities.

Additionally, SF Environment and OEWD will target local, small, minority-owned, and women-owned businesses to increase enrollment in continuing training and certification programs, including EVITP certification for electricians. Additionally, SF Environment and community-based organizations currently support a hyper-local workforce development model for its Climate Equity Hub to engage and train disadvantaged community members in building decarbonization jobs. SF Environment will derive learnings from the success of this project to work with CBOs on expanding job training to include charging installation, EVITP, and MDHD ZEV maintenance. This effort will begin with outreach to hard-to-reach fleets. Please see Strategy A Action 1.

As the City fleet advances its fleet transition, SF Environment will also work with Central Shops and other departments to identify light-duty and MDHD ZEV and charging/fueling operations and maintenance training and education needs for City fleet and facility managers and contractors. SF Environment will support the development of citywide guidelines that promote local procurement preferences for ZEV infrastructure installation and vehicle and infrastructure maintenance.

Develop Land Use Laws to Encourage the Installation of ZEV Charging Infrastructure

Action Lead(s)	Supporting Department(s)
SF Planning	SF Environment

Tasks	Timeline
Convene relevant partners to resolve land use restrictions to ease the permitting process of designated fleet charging uses	Near-Term
Streamline land use policy for fleet charging projects to facilitate infrastructure deployment for priority small- and medium-sized fleets	Near-Term
Develop educational materials to assist EVSE permit customers with navigating the Conditional Use Authorization process while including information about available incentives for EVSE installation	Near-Term

CONTEXT

San Francisco uses zoning regulations, a key component of land use laws, to designate zones with specific permitted uses, heights, parking limits, historic preservation controls, and other requirements. The City encourages significant public input to ensure community interests are considered in these decision-making processes.

In 2022, San Francisco updated the Planning Code to include new definitions and regulations for EV charging facilities.[xl] The legislation created two new land use definitions: Electric Vehicle Charging Location (retail EV charging facilities for the public) and Fleet Charging (private EV charging facilities meant to charge EVs that will then leave the facility, and not remain parked/stored at the facility). The legislation also established zoning regulations for these land uses, including where these uses are principally permitted, require a Conditional Use Authorization (CUA), or are not permitted at all. In all zoning districts, existing automotive uses such as gas stations or private parking lots may be converted to an Electric Vehicle Charging Location without a CUA. However, Fleet Charging requires a CUA in nearly all zoning districts.

The Planning Code clearly allows for the installation and use of EV charging stations for sites with private parking, but there are less traditional models that would be designated as Fleet Charging and may be hindered by the new CUA requirement for Fleet Charging sites. For example:

- A cluster of businesses with small fleets looking to install a shared direct current (DC) fast charging station separate from their on-site parking locations

- A warehouse looking to install charging stations at loading docks to provide opportunity charging for trucks awaiting loading or unloading

The Planning Code also prohibits Fleet Charging as an accessory use to any other use, including at publicly accessible Electric Vehicle Charging Locations, which would require the site to acquire its own Fleet Charging authorization through the CUA process. This distinction restricts hybrid models of publicly accessible charging stations with a few spots leased exclusively to a private fleet, which is a strategy currently being tested by some EV charging providers.

BARRIERS

The introduction of autonomous vehicles (AVs) in San Francisco has raised concerns from lawmakers about road safety and increased vehicle miles traveled (VMT), which runs counter to City goals laid out in the Climate Action Plan. The San Francisco Board of Supervisors (BOS) has looked to use the Planning Code as a means of increasing scrutiny of AV Fleet charging sites to mitigate their impact. This costly and time-consuming permitting process creates unintended barriers for other Fleet Charging uses, including small- and medium-sized fleets moving goods throughout the City. These barriers are not insurmountable, but require resources and technical assistance to understand and navigate the regulatory process. Small- and medium-sized fleets that do not have the capacity to navigate the regulatory process may be disincentivized to pursue shared charging.

TASKS

SF Environment will convene regular meetings with SF Planning and the City's EV Ombudsperson to identify emerging charging projects, streamline the EVSE entitlement process, and proactively solve associated land use challenges. This will provide the City with information to advance constructive revisions to current land use legislation.

SF Environment will develop policy recommendations to ease the permitting process of designated fleet charging uses. Along with SF Planning, SF Environment will:

- Clarify the types of charging applications that require additional scrutiny by the BOS,
- Clarify to the BOS the criteria that the Planning Commission uses to rule on CUAs related to fleet charging

Finally, with support from SF Environment, SF Planning will develop and regularly update materials describing the current zoning and CUA process for EV charging projects, with reference to additional information on available EV charging infrastructure incentives that SF Environment will incorporate into its fleet outreach efforts (see Strategy A).

Develop Microhubs to Shift Last-Mile Deliveries from Medium-Duty Vehicles

Action Lead(s)	Supporting Department(s)
SFCTA	SFMTA, SF Environment

Tasks	Timeline
Secure funding and develop an in-depth site suitability analysis and identify up to 5 potential pilot locations and site configurations	Near-Term
Explore changes to San Francisco street design guidelines and vehicle regulations to help facilitate the use of e-cargo bikes in support of microhubs	Near-Term
Launch a pilot microhub	Medium-Term

CONTEXT

On-demand delivery has provided convenient access to goods, but has also brought challenges such as increased traffic congestion and emissions from delivery vehicles as well as increased competition for limited curb space. Zero-emission micro-logistics hubs, or microhubs, have emerged as a viable solution by offering a more efficient and sustainable approach to last-mile delivery.

Microhubs are strategically located mini-distribution centers that act as consolidation points, receiving packages from fulfillment centers and sorting them for final delivery by low- to no-carbon modes such as light-duty EVs, e-cargo bikes, or other forms of micromobility. This reduces traffic congestion caused by urban freight, aligns with the City's VMT reduction goals, and eliminates tailpipe and—as the city reaches its renewable electricity goals—GHG emissions. Microhubs can improve delivery speeds by bringing packages closer to their destinations, potentially leading to faster and more reliable service for customers.

Microhubs can shift modes away from medium-duty vehicles and onto more sustainable options, including micromobility or light-duty EVs. Right-sizing last-mile delivery in this way can help alleviate strain on the electrical grid by reducing the number of ZEVs needing to charge at peak times.

Microhubs also offer co-benefits beyond emissions reduction, including the promotion of safer streets and the potential for community revitalization. Fewer delivery trucks on the road or at the curb translates to safer streets for pedestrians and cyclists, creating a more walkable and bikeable environment.

BARRIERS

There are a number of challenges to successful microhub implementation, which include the delivery mode, the delivery time, and coordination with stores. Implementing successful microhubs will require coordination across all stakeholder groups including store owners, delivery companies, and delivery workers.

Additionally, land costs in San Francisco are high and zoning regulations make it difficult to establish microhubs near high-traffic areas. Integrating microhubs seamlessly into existing urban infrastructure requires planning that involves consideration of dedicated loading zones, bike lanes, or even micro-depots within parking lots or buildings to facilitate smooth last-mile and “last 30 feet” deliveries.

The success of microhubs hinges on providing sufficient infrastructure, programs, and policies through coordination among City entities, delivery companies, retailers, and customers to ensure smooth flow of goods through the hubs, minimal interruption to traffic and businesses, and safety.

TASKS

The San Francisco County Transportation Authority (SFCTA), a local agency responsible for planning, funding, and delivering transportation projects throughout San Francisco, is currently conducting an Eco-Friendly Downtown Delivery Study[xli] that involves a working group of local merchant associations, community benefit districts, delivery companies, and environmental groups to propose low- and zero-emission delivery approaches. Part of this study includes investigating the potential for microhubs to provide last-mile delivery solutions, which will provide further guidance on their feasibility. The study will be complete in 2025.

Based on the results of the initial study, the City will:

- Secure funding and develop an in-depth site suitability analysis in partnership with fleet partners that explores locations and facilities in San Francisco best suited to support a microhub pilot, and identify up to 5 potential pilot locations. The study should consider City-owned real estate such as vacant/off-market properties and underutilized off-street parking facilities, coordinating with SF Planning, the Real Estate Division of ADM, and other City agencies that track and manage City property. The study should also develop business plans for each recommended pilot location, which would include a description of roles/responsibilities for operations and financial arrangements as well as optimal site configurations and loading/unloading zones to support efficient access for smaller delivery vehicles.
- Explore changes to San Francisco street design guidelines and vehicle regulations to help facilitate the use of e-cargo bikes and other forms of micromobility in support of microhubs and last-mile delivery, including studying bike-lane width to determine optimal designs for accommodating e-cargo bicycles.
- Launch a pilot microhub to test the operational challenges and opportunities and develop a model for implementation of future microhubs.

Strategy C: Convert the Municipal Fleet to ZEVs

Support the City in reaching its 10,000 MDHD goal through transition of the municipal fleet.

ACTIONS

- Establish a City Fleet ZEV Transition and Infrastructure Plan and Decision-Making Structure
- Identify Grid-Integration and Off-Grid Opportunities to Support Energization and Increase Public Fleet Resiliency

Establish a City Fleet ZEV Transition and Infrastructure Plan

Action Lead(s)	Supporting Department(s)
ADM- Central Shops	SF Environment, SFPUC

Tasks	Timeline
Evaluate City fleet duty cycles, travel needs, and current domicile locations to determine preferred fleet charging network model	Near-Term
Gather data on electrical capacity at City fleet domicile locations	Near-Term
Gather lessons learned on solicitation to partner with publicly accessible charging network providers	Near-Term
Consider future MDHD charging needs at sites identified for Citywide light-duty fleet charging deployment	Medium-Term
Draft a comprehensive schedule and budget for purchasing MDHD ZEVs while concurrently upgrading electrical infrastructure and installing charging stations	Medium-Term
Explore the potential of adopting hydrogen vehicles to supplement MDHD EVs and develop a hydrogen fueling station exclusively for city vehicles	Long-Term
Procure 100% MDHD ZEVs for the City fleet as vehicle models that meet daily usage needs become available	Long-Term

CONTEXT

In 2025 Central Shops completed an initial ZEV Transition Outlook that outlines existing regulations driving the City's ZEV goals, current technical and institutional electrification barriers, and what steps need to be taken to bridge the gaps.

The City's public fleet consists of approximately 8,500 vehicles that are used to support municipal operations and service delivery. Nearly 3,500 of these vehicles are MDHD, all of which will need to be electrified to meet CARB's goal of electrifying all MDHD vehicles in California by 2045. ACF requires that between 2024 and 2027, 50% of all MDHD vehicles purchased by state and local fleets must be ZEVs. This mandate increases to 100% in 2027.

Electrifying the City fleet will come with economic benefits beyond a simple reduction of emissions. While the upfront cost of EVs might be higher, lower fuel and maintenance costs over the lifetime of the vehicles are projected to lead to savings for the City. Additionally, federal and state incentives have the potential to significantly reduce the cost of purchasing ZEVs and purchasing and installing charging infrastructure needed to fuel the vehicles. Taking advantage of these opportunities before funding expires is critical. Finally, transitioning the City's MDHD fleet will advance the City toward medium-term goals of transitioning 10,000 MDHD vehicles by 2030. The City can "lead by example" in supporting other fleet transitions by sharing learnings, charging models, accessing incentives, and other key information.

BARRIERS

As of November 2024, the City owns only 18 MDHD ZEVs. The lack of MDHD ZEVs is due to several factors including a lack of dedicated funding for purchasing fleet vehicles, a lack of ZEV models suitable for city demands, a fear about ZEV reliability during emergencies, and a lack of electrical capacity to install onsite charging for MDHD ZEVs. Taken one at a time, these barriers are solvable, but the confluence of challenges inhibits forward progress.

Currently, the City has a decentralized approach to ZEV transition planning. While Central Shops oversees vehicle procurement across departments, each individual department must implement its own acquisition plan across its domicile locations, including allocating resources for both vehicle procurement and charging/fueling infrastructure installation. This process is also not consistent across departments. For example, departmental fleet team plans to procure vehicles may not align with facilities team plans that operate or lease parking/domicile locations, meaning that procurement timelines often do not match charging installation timelines.

Adding further difficulty is the challenge of complex grid upgrades often required by MDHD ZEV charging infrastructure. The lack of access to charging infrastructure is already a major barrier even for the light-duty ZEV transition, and City grid capacity constraints result in high costs or delays to installing charging. The City is currently pursuing two parallel infrastructure models – access to privately-owned, publicly accessible or shared-private charging infrastructure and installing City-owned charging on City property. Light-duty fleet charging needs generally differ significantly from MDHD, but as these two infrastructure deployment models advance, it may be helpful to consider where there are opportunities to expand partnerships with the private sector and/or "dig once" to install electrical infrastructure that can support MDHD charging when we're already completing civil work for a large light-duty charging project at the same site.

TASKS

To begin developing an interdepartmental, comprehensive approach to MDHD ZEV adoption, Central Shops applied for and received funding from MTC in 2024 to hire a technical consultant to assist with evaluating City fleet duty cycles and domicile locations and electrical capacity data at domicile sites to propose a strategic plan for electrification of the City fleet. Central Shops and MTC will launch this strategic planning in Q1 2025. Working with the consultant and regional partners, Central Shops will explore the potential of different technologies, siting networks, and/or scheduling systems to support phased vehicle and equipment procurement, charging infrastructure deployment, and coordination between enterprise and general fund departments.

One key determination that Central Shops hopes to address through this plan is whether the City fleet should pursue a distributed charging network – e.g., aligning with current or planned domicile locations – or prioritize building out centralized fleet charging hubs, which could result in cost savings with the tradeoff of reorganizing vehicle operations or parking locations.

While the City has already compiled data on fleet vehicle composition and domicile locations through this Blueprint development effort and other planning workstreams, the City still needs information on the current status of fleet vehicles and domicile locations, including replacement schedules and existing electrical capacity. With the support of the technical consultant, the City can draft a comprehensive schedule and budget for procuring MDHD ZEVs while concurrently upgrading electrical infrastructure and installing charging stations at target sites.

This planning work will also be informed by lessons learned from both a privately funded, publicly accessible charging solicitation and CEC-funded light-duty fleet charging grant that Central Shops will begin to implement in 2025. The City can develop lessons learned from the publicly accessible charging partnership to see how this model could support he City in accessing sharing MDHD charging networks in the future, as well as consider MDHD charging needs at sites currently identified for light-duty charging implementation and attempt to align construction timelines in order to “dig once”.

Additionally, hydrogen fuel cell technology has the potential to support heavier-duty vehicles[xlii] given its potential for longer range and lighter weight compared to battery electric vehicles. The City has begun exploring the potential of adopting hydrogen vehicles to supplement MDHD EVs and potentially develop a hydrogen fueling station exclusively for City vehicles. Recology, which provides San Francisco’s waste management and resource recovery, recently piloted at hydrogen fuel cell-powered truck on San Francisco’s unique terrain (See Figure 17 below). This effort aligns with both San Francisco’s and regional efforts to advance hydrogen fuel cell technology as a solution for heavy duty vehicles.[xliii]

With these fleet transition and infrastructure plans in place, the City can begin procuring 100% MDHD ZEVs for the City fleet as soon as vehicle models are available that meet daily usage needs. In the meantime, SF Environment will continue to support Central Shops and individual City departments – such as those that have identified priority locations within the MDHD Charging Suitability Mapping Tool – to begin to pilot ZEVs and charging infrastructure with the support of available regional, state, and federal funding opportunities.

RECOLOGY HYDROGEN FUEL CELL PILOT

FIGURE 17: RECOLOGY HYDROGEN FUEL CELL REFUSE COLLECTION TRUCK

In August 2024 Recology became the first waste and recycling company in the US to pilot a hydrogen fuel cell-powered electric refuse collection truck[xliv]. Recology partnered with New Way and Hyzon to test the cutting-edge technology on the streets of San Francisco as part of its pioneering efforts to reduce waste and use clean energy.

Recology used the truck in San Francisco on full service including about 600 residential waste bin lifts, and has successfully tackled as much as a 27% grade on the City's hills. On a single fueling of its hydrogen tank, the truck completed multiple service days and had no issue with heavy payloads.

The US DOE notes that hydrogen fuel systems "are more efficient than conventional internal combustion engine vehicles and produce no harmful tailpipe emissions."

The truck is slated to be piloted through the end of 2025.

"Addressing climate change and air pollution, regionally and nationally, requires us to look at the vehicles we rely on every day to provide essential services to our communities," said Tyrone Jue, Director of the San Francisco Environment Department. "Recology has long partnered with the City to protect our environment by pioneering how we reduce waste. Now I'm excited to see how Recology is also helping us meet our aggressive greenhouse reduction goals through cleaner vehicles," Jue added.

Identify Grid-Integration and Off-Grid Opportunities to Support Energization and Increase Public Fleet Resiliency

Action Lead(s)	Supporting Department(s)
SF Environment	ADM – Central Shops, SFPUC

Tasks	Timeline
Coordinate with City fleets to incorporate vehicle-grid integration methods into charging projects and practices	Medium-Term
Evaluate potential site hosts and funding for on-site storage and/or microgrid facilities	Long-Term
Explore bi-directional charging opportunities	Long-Term

CONTEXT

Vehicle-grid integration (VGI) methods and microgrids offer promising solution to concerns about grid interconnection and reliability due to lack of available grid capacity or potential power outages during extreme weather events and disasters. VGI methods such as load shifting and managed charging can mitigate energization costs and timelines by reducing peak charging demand and avoiding concurrence with the grid peak, avoiding the need for significant upgrades and supporting fleets in maintaining daily operational requirements after transition to ZEVs.

Off-grid solutions such as backup power or microgrids can similarly mitigate the need for extensive grid upgrades while also supporting resiliency. A microgrid is a small, controllable power system that can operate independently or in conjunction with a larger utility grid. Microgrids can pair clean energy sources such as solar panels with battery storage, reducing reliance on the traditional grid. In interviews, City fleet managers voiced concerns about MDHD ZEV performance during emergencies, particularly as it relates to ZEV battery life and charging options. Battery storage and microgrids have the potential to solve this issue, providing on-demand power during emergencies, bolstering City resiliency and leading by example for other fleets with similar concerns.

Additionally, VGI methods such as bi-directional charging can also empower fleets to not only charge their ZEVs but also to feed excess power back into the grid or building during peak demand periods. This two-way flow of energy strengthens grid resilience – and could provide revenue streams to the City – by providing backup power to critical operations during outages and utility demand response events.

BARRIERS

Despite the potential benefits, VGI methods may require the adoption of new technologies or operational practices, and the upfront costs of installing solar panels, battery systems, and the necessary control technology for microgrids can be significant. Additionally, navigating the complex

regulatory landscape surrounding microgrids and connecting them to the main grid can be a time-consuming process.

Coordination between different partners like City fleet operators, City real estate managers, infrastructure vendors, SFPUC, and PG&E to plan, finance, and manage microgrids will require strong collaboration and clear communication.

TASKS

As the City begins to adopt ZEVs and install associated charging infrastructure, it can work with EVSE providers and SFPUC to explore load management methods and on-site energy generation and storage as methods to mitigate interconnection costs and delays.

To begin considering microgrid development, SF Environment will coordinate with Central Shops, the SFPUC Distributed Energy Resource Projects team, and individual departments to determine potential City fleets and sites that are suitable for hosting on-site renewable energy and battery storage and that would best support existing and planned electrification. Technical and regulatory research is required to understand the relevant battery storage and microgrid solutions, permitting processes, interconnection requirements, and any financial incentives available. The City can build on lessons learned from SFMTA's Zero Emission Bus Rollout and other existing solar and storage projects as well as a microgrid pilot currently in-progress.

SF Environment will engage with fleet and facility managers to identify departments willing to pilot a microgrid project and, through regular meetings with SFPUC and PG&E, explore opportunities for public fleets to participate in utility VGI programs as they develop.

Conclusion

The San Francisco MDHD ZEV Blueprint represents a significant step forward in the City's commitment to sustainability and climate action. This Blueprint outlines specific strategies, actions, and tasks; fosters robust community and partner engagement; and leverages innovative mapping tools to lay a solid foundation for transitioning 10,000 MDHD vehicles to ZEVs by 2030 and achieving 100% MDHD ZEV adoption by 2045. The comprehensive approach detailed in the Blueprint, which includes broad partner collaboration and detailed data analysis, provides a replicable model that can be scaled beyond San Francisco to other cities and regions.

The extensive engagement with diverse partners, including public sector entities, utilities, local businesses, and CBOs, to develop this Blueprint ensures that the strategies are well-aligned with the needs and interests of all impacted parties. This inclusive approach not only built trust around the City's shared commitment toward achieving net zero emissions, but also strengthened existing and launched new collaborations that are essential for successful implementation of ZEV initiatives. The lessons learned from this process highlight the importance of participant perspectives, structured facilitation, leadership and centralization of information, and continuous feedback mechanisms.

The creation of the MDHD Charging Suitability Mapping Tool exemplifies the innovative use of data and technology to site charging infrastructure. By integrating multiple data sources and employing a suitability analysis, the mapping tool provides valuable insights into the optimal locations for MDHD ZEV charging infrastructure. This tool not only supports San Francisco's ZEV goals but also offers a model for other cities to identify and prioritize their own ZEV infrastructure needs.

The Blueprint's strategic recommendations and pilot projects address key barriers to MDHD ZEV adoption, such as grid upgrades, skilled labor requirements, and land use challenges. The Blueprint outlines the City's near-term priorities, many of which are already in process, particularly Strategy C: Convert the Municipal Fleet to ZEVs, which will significantly advance the City toward its 2030 MDHD adoption goals. The City has the opportunity to lead by example, and will share what it learns through its own MDHD adoption process with small- and medium-sized fleets, to ensure that hard-to-reach fleets are incentivized and supported in adoption. A new Urban Freight and Fleet Decarbonization team can coordinate implementation of this Blueprint's strategies and actions, including seeking funding opportunities. Continuous refinement of these strategies and actions will position San Francisco to lead the way in urban sustainability, setting a precedent for other cities striving to achieve similar environmental goals.

Appendix A: Glossary and Acronyms

ACT	Advanced Clean Trucks – Established in June 2020, the ACT rule sets goals and mandates for the types of MDHD vehicles that can be sold in California. The regulation requires manufacturers who certify Class 2b-8 chassis or complete vehicles with combustion engines to sell zero-emission trucks as an increasing percentage of their annual California sales from 2024 to 2035.
ACF	Advanced Clean Fleets – Established in April 2023, the ACF rule requires large carriers to transition their fleets to ZEVs by 2045, with deadlines for specific vehicle types starting in 2024. The regulation applies to trucks performing drayage operations at seaports and railyards; fleets owned by state, local, and federal government agencies; and high priority fleets, defined as entities that own, operate, or direct at least one vehicle in California and that have either $50 million or more in gross annual revenue, or that own, operate, or have common ownership or control of a total of 50 or more vehicles. The regulation affects MDHD on-road vehicles with a gross vehicle weight rating greater than 8,500 pounds, off-road yard tractors, and light-duty mail and package delivery vehicles.
ADM – Central Shops	San Francisco Office of the City Administrator – Central Shops (Fleet Management Division)
CARB	California Air Resources Board
CBO	Community-Based Organization
CEC	California Energy Commission
CEQA	California Environmental Quality Act – In San Francisco, environmental impact documents, agendas, and notices are filed with the Office of the County Clerk and are posted for 30 calendar days.
CPUC	California Public Utilities Commission
DAC	Disadvantaged Communities refer to the areas throughout California which most suffer from a combination of economic, health, and environmental burdens.
DOE	(United States) Department of Energy
DPW	Department of Public Works – A public agency with many responsibilities including sidewalk and sidewalk vault maintenance and public street signage production and installation.
E-Bike	Battery-electric Bicycle
EV	Electric Vehicle

EVSE	Electric Vehicle Service Equipment
FCEV	Fuel Cell Electric Vehicle – A type of EV that primarily uses high pressure hydrogen stored in a fuel cell, instead of fuel tank, to power the vehicle's electric motor.
ICE	Internal Combustion Engine
LIC	Low Income Community – Census tracts that are either at or below 80% of the statewide median income, or at or below the threshold designated as low-income by the California Department of Housing and Community Development's 2016 State Income Limits.
MDHD	Medium- (Classes 2b to 6) and Heavy-Duty (Classes 7 and 8) vehicles, with a gross vehicle weight rating greater than 8,500 pounds
O&M	Operations and Maintenance
PG&E	Pacific Gas and Electric – The investor-owned electric and natural gas utility whose territory includes San Francisco.
SFCTA	San Francisco County Transportation Authority – A public agency, chartered by the State of California to provide sub-regional transportation planning and programming agency for San Francisco County. The agency primarily works to reduce congestion.
SFMTA	San Francisco Municipal Transportation Authority – A public agency created by consolidation of the San Francisco Municipal Railway, the Department of Parking and Traffic, and the Taxicab Commission. The agency oversees public transport, taxis, bicycle infrastructure, pedestrian infrastructure, and paratransit for the City and County of San Francisco.
SFPUC	San Francisco Public Utilities Commission – A public agency of the City and County of San Francisco that provides water and wastewater services to residents and businesses withing the city and serves as the primary electricity provider within the City through its two programs: Hetch Hetchy Power and CleanPowerSF, San Francisco's community choice aggregator.
SF Environment	San Francisco Environment Department – A public agency that is responsible for drafting the City and County of San Francisco's Climate Action Plan, including the strategies, objectives, and tactics, as well as for tracking emissions and ensuring environmental justice is served.
The City	City & County of San Francisco
TAC	Technical Advisory Committee composed of public sector partners, utilities, City departments, community-based organizations, local businesses, and fleet representatives directly engaged in MDHD fleet

	electrification in San Francisco to guide the development of the Blueprint.
Vehicle	A mode that transports people and goods from one location to another on land, such as a car, truck, motorcycle, scooter, motor-driven cycle, or bicycle.
Working Group	A committee or group appointed to study and report on a particular question and make recommendations based on its findings.
ZEV	Zero-Emission Vehicle – Vehicle that produces zero tailpipe emissions of atmospheric pollutants. A ZEV can be powered by a number of technologies, including electric batteries and hydrogen fuel cells.

Appendix B: Technical Advisory Committee

SF Environment worked with Central Shops and the San Francisco Clean Cities Coalition to establish an MDHD ZEV Technical Advisory Committee (TAC) and conduct engagement activities across three key audiences: the municipal fleet, small- and medium-sized commercial fleets, and impacted communities. Below is the list of entities and entity type who participated in the TAC. To review the complete TAC Charter and all TAC meeting minutes, please see accompanying Appendix B *TAC Committee Charter* and *TAC Meeting Materials*.

CALSTART	*Advocacy / Industry Council*
InCharge Energy	*Charging Provider*
EVgo	*Charging Provider*
WattEV	*Charging Provider*
SF Municipal Transportation Agency	*City Department*
SF Office of the City Administrator – Central Shops	*City Department*
SF Department of Public Works	*City Department*
SF Recreation & Parks Department	*City Department*
Sacramento Clean Cities Coalition	*Clean Cities Coalition*
Leaders for Environmental Activism Reclaiming Their Health (Leaders4E.A.R.T.H) – Mission Neighborhood Center	*Community-Based Organization*
SF Environment Racial Equity Team	*Community Partner*
The SF Market	*Local Business*
Meals on Wheels	*Local Business*
Golden Gate Truck Center (Freightliner, Kenworth, Isuzu, Western Star)	*Original Equipment Manufacturer*
PG&E	*Utility*
San Francisco Public Utilities Commission	*Utility*

Appendix C: Pilot and Innovation Implementation

To support small- and medium-sized fleets, this Blueprint identifies two pilot charging projects aimed to serve specific cohorts of small- and medium-sized fleets. SF Environment worked with Arup to review the types of pilot projects that the City is in the best position to advance. Please see the accompanying Appendix C *Pilot Implementation Plan* and Appendix C *Innovations Report* to review the detailed plan, including funding matrix.

Appendix D: Disadvantaged Community Needs Assessment

SF Environment conducted Outreach and Partner Engagement with community members and community-based organizations, interested parties and stakeholders/partners, and City departments. SF Environment created an engagement plan for conducting this outreach and advisory activities. This plan can be reviewed in detail in the accompanying Appendix D Engagement Plan.

Part of this plan included specific engagement with Disadvantaged Communities. To do this, SF Environment developed the DAC Needs Assessment Survey to understand community concerns over land use, traffic safety, congestion, and other impacts resulting from siting charging stations for MDHD ZEVs in underserved communities, and partnered with Strategies 360, to run the representative survey of residents living in the Bayview-Hunters Point neighborhood and the surrounding areas. Emissions are highest along heavily traveled highways: US 80, US 101, Interstate 280, and feeder roads that connect to the city's industrial and distribution areas. Adjacent neighborhood Bayview-Hunters Point, is disproportionately burdened by this pollution and has been certified disadvantaged communities (DACs) by CalEnviroScreen 4.0. In addition to high pollution, these neighborhoods are also home to some of the highest concentration of domiciled fleets. To read the complete DAC survey process, please see the accompanying Appendix D *Disadvantaged Community Needs Assessment Survey*, and to read the full survey results, please see Appendix D *Disadvantaged Community Needs Assessment*.

Appendix E: Small Fleet Survey Details

SF Environment developed the Small Fleets Survey to compile information on current fleet operations as well as determine barriers to ZEV adoption for small MDHD fleets. SF Environment leveraged the Clean Cities Coalition network to compile contact information and disseminate the survey to roughly 170 fleets based in San Francisco. In addition to direct outreach, SF Environment partnered with the SF Chamber of Commerce as well as members of the TAC to share the survey with their networks. Overall, the survey reached nearly 9,000 contacts, though it is unknown how many of these contacts own or operate fleets.

For this exercise, SF Environment defined “small fleet” as a fleet with 1 to 10 MDHD vehicles. To increase understanding of challenges to adoption, SF Environment also did outreach to larger fleets. Given the low number of responses (13 responses in total from all outreach efforts), the survey results include all fleet responses (responses from both small and larger fleets). Some fleets only had light-duty vehicles, meaning that depending on the fleet, they might have 0% to 100% MDHD vehicles. To read the complete, detailed survey process, please see the accompanying Appendix E *Small Fleets Needs Assessment Survey*, and to read the detailed findings, please see the accompanying Appendix E *Small Fleets Needs Assessment Survey.*

Appendix F: Municipal Fleet Engagement Details

San Francisco's municipal fleet contains nearly 3,500 MDHD vehicles that are used across multiple departments to maintain City operations and advance City goals and priorities. SF Environment conducted a series of interviews of high priority departments to determine the challenges that each department faces in beginning to electrify their MDHD fleets. Interviews and site visits were conducted with the San Francisco Recreation and Parks Department (REC), the San Francisco Municipal Transportation Agency (SFMTA), and the San Francisco Department of Public Works (DPW) with the intent of collecting information on vehicle inventory, operations, miles-traveled, and challenges to electrification. Vehicle inventory and interviews are below.

San Francisco Recreation & Parks Department

Vehicle Locations	Vehicle Count
100 Martin Luther King Jr Dr, San Francisco, CA 94122, USA (Golden Gate Park Shop)	84
National AIDS Memorial Grove, Nancy Pelosi Drive &, Bowling Green Dr, San Francisco, CA 94122, USA	14
Harding Park - Golf Course and Maintenance Yard	10
800 John F Kennedy Dr, San Francisco, CA 94122, USA	8
755 Stanyan St, San Francisco, CA 94117, USA	7
62-98 Sgt John V Young St, San Francisco, CA 94112, USA	6
899 Martin Luther King Jr Dr, San Francisco, CA 94122, USA	6
650 La Grande Ave, San Francisco, CA 94112, USA	5
811 Stanyan St, San Francisco, CA 94117, USA	5
50 John F Shelley Dr, San Francisco, CA 94134, USA	5
Park Stables, Golden Gate Equestrian Center, San Francisco, CA 94122, USA	5
Middle Dr W, San Francisco, CA 94122, USA	4
614 University St, San Francisco, CA 94134, USA	4
1 Harding Rd, San Francisco, CA 94132, USA	4
199 Museum Way, San Francisco, CA 94114, USA	4
Larkin St & Mcallister St, San Francisco, CA 94102, USA	4
3120 Quintara St, San Francisco, CA 94116, USA	3
166 Havelock St, San Francisco, CA 94112, USA	3
355 McAllister St, San Francisco, CA 94102, USA	2
600 Arguello Blvd, San Francisco, CA 94118, USA	2
5836 Palace Dr, San Francisco, CA 94123, USA	2
QG98+2C Golden Gate Park, San Francisco, CA, USA	2
899 Lake Merced Blvd, San Francisco, CA 94132, USA	2
253 Drumm St, San Francisco, CA 94111, USA	2
95 Justin Dr, San Francisco, CA 94112, USA	2
300 34th Ave, San Francisco, CA 94121, USA	1
QG88+WM Golden Gate Park, San Francisco, CA, USA	1
451 Berry St, San Francisco, CA 94158, USA	1
Stanyan Skatepark, 755 Stanyan St, San Francisco, CA 94117, USA	1
45th Ave, San Francisco, CA 94122, USA	1
501 Stanyan St, San Francisco, CA 94117, USA	1
QG88+XJ Golden Gate Park, San Francisco, CA, USA	1
100 Washington St, San Francisco, CA 94111, USA	1
50 Scott St, San Francisco, CA 94117, USA	1
100 Yacht Rd, San Francisco, CA 94123, USA	1
Golden Gate Park CommUNITY Garden, 780 Frederick St, San Francisco, CA 94117, USA	1
St. Mary's Dog Park, 221 Justin Dr, San Francisco, CA 94112, USA	1
QG98+4C Golden Gate Park, San Francisco, CA, USA	1
100 John F Kennedy Dr, San Francisco, CA 94118, USA	1
962-952 Martin Luther King Jr Dr, San Francisco, CA 94122, USA	1
911 Stanyan St, San Francisco, CA 94117, USA	1
3782 18th St, San Francisco, CA 94114, USA	1
2450 Harrison St, San Francisco, CA 94110, USA	1
Accessible Parking Lot, San Francisco, CA 94122, USA	1
QG88+XC Golden Gate Park, San Francisco, CA, USA	1
5517 Yacht Rd, San Francisco, CA 94123, USA	1
2554 Grant Ave, San Lorenzo, CA 94580, USA	1
QG98+2G Golden Gate Park, San Francisco, CA, USA	1
903 Gilman Ave, San Francisco, CA 94124, USA	1
2000 Martin Luther King Jr Dr, San Francisco, CA 94122, USA	1
CA-120, Groveland, CA 95321, USA	1
83 Marina Green Dr, San Francisco, CA 94123, USA	1
Holly Park, 625 Holly Park Cir, San Francisco, CA 94110, USA	1
QG98+4J Golden Gate Park, San Francisco, CA, USA	1
PGG2+7M, San Francisco, CA 94132, USA	1
265 Drumm St, San Francisco, CA 94111, USA	1
Forest Rte 1N07, Groveland, CA 95321, USA	1
2670-2682 Francisco Blvd, Pacifica, CA 94044, USA	1
50 Bowling Green Dr, San Francisco, CA 94117, USA	1
2684 Francisco Blvd, Pacifica, CA 94044, USA	1
825 Stanyan St, San Francisco, CA 94117, USA	1
2745 Larkin St, San Francisco, CA 94109, USA	1
1906 Earthquake Shack, San Francisco, CA 94132, USA	1
Total	**233**

FIGURE 18: SAN FRANCISCO RECREATION & PARKS DEPARTMENT – COUNT OF MDHD VEHICLES BY ADDRESS

Vehicle Type	Vehicle Count	Average Daily Mileage
Pickup	59	8.22
Small Offroad	1	
Truck	16	7.69
Van	8	8.64
Total	*84*	

FIGURE 19: MDHD VEHICLES BY TYPE AND AVERAGE DAILY MILEAGE, GGP SHOP

REC INTERVIEW DETAIL

The Golden Gate Park Structural Maintenance Yard (GGP Shop – Figure 20) houses the department's administrative offices, as well as several workshops and parking depots for various trades including electrical, plumbing, carpentry, and more. The GGP Shop is home to roughly 100 MDHD vehicles, ranging from pickups and vans to large trucks and other heavy-duty vehicles.

Prior to the interviews, the REC fleet manager had done some work to explore the possibility of electrifying the REC fleet. He attended several conferences to learn about new EVs that might work for the department's fleet and engaged two different EV Service Providers (EVSPs) to determine the feasibility of installing charging infrastructure at the department's main GGP Shop location. One of the EVSPs, Blink Charging, performed a site evaluation and provided several quotes for different charging solutions.

The GGP Shop is a high-priority site for charging infrastructure because of the high number of vehicles domiciled there. The site also presents a good opportunity to pilot the electrification of specific vehicles in the department's fleet, and target vehicle types and user groups with predictable duty-cycles. For example, vehicles assigned to stationary engineers, plumbers, iron tradespeople, and heavy equipment operators (HEO) see the highest daily average miles driven. These user groups alone account for over half of the vehicles at the GGP Shop and most of their vehicles are pickups, which are good candidates for early electrification. Vehicles assigned to specific user groups also tend to be parked near one another and the appropriate workshop within the GGP Shop, so charging infrastructure could be concentrated in those high-priority areas.

Those parking areas nearest the main electrical service panel may present the most affordable options for early installation of charging infrastructure (see Figure 20).

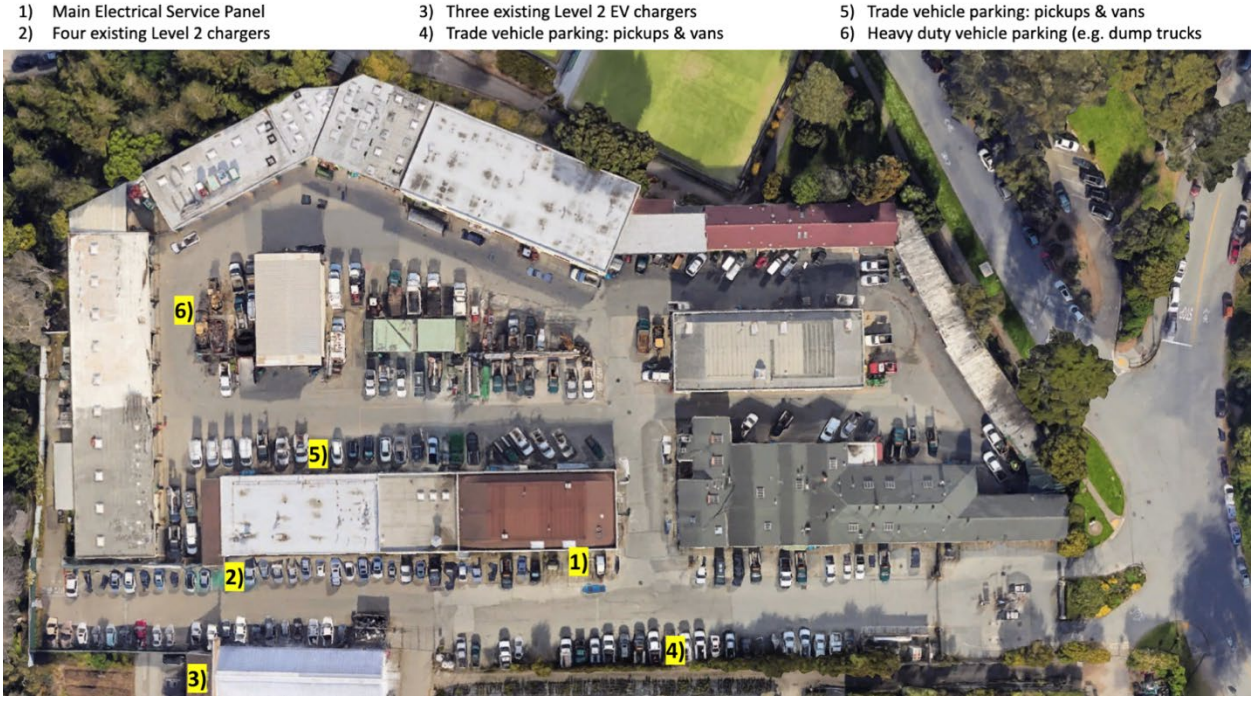

FIGURE 20: AERIAL VIEW OF GOLDEN GATE PARK STRUCTURAL MAINTENANCE YARD

The department fleet manager detailed several key challenges the department faces in procuring electric vehicles and installing charging infrastructure.

FUNDING

Many parking locations for the department's fleet vehicles will require electrical service upgrades before adequate charging infrastructure can be installed. These upgrades are often cost prohibitive and involve years-long lead times.

VEHICLE MODELS & AVAILABILITY

The department's fleet includes many vehicle types for which there are not yet electric alternatives. Even many of the pickup trucks, like Ford F-250s or F-350s are difficult to replace with EVs right away due to volatile markets, and employees rely on special features like dump bed capabilities, lift gate or power take-off units to perform work. The current electric cargo vans on the market do not have enough battery capacity to meet the department's needs. Other vehicle types like dump trucks or off-road equipment may not have proven EV alternatives on the market.

RELIABILITY OF EVS FOR EMERGENCY RESPONSE

Many of the department's vehicles are used for responding to emergency situations, and problems may arise if charging infrastructure goes offline during extended power outages from weather events or earthquakes. One of the most common emergency response tasks that Recreation & Parks handles is clearing fallen trees from roads which often requires larger bucket trucks or chipper

trucks. Trade worker vehicles may be dispatched for other emergency situations including plumbing or electrical issues that require an immediate response.

ELECTRIC SERVICE AT PARKING SITES

The Department has more than 10 sites that do not have any electrical service. These locations include parks and other sites across the city where the department keeps vehicles and other equipment with limited buildings or other infrastructure to support charging.

CAMP MATHER SITE

The department is responsible for maintaining and operating Camp Mather each summer, which is located outside Yosemite National Park in Groveland, CA. Opening the site at the beginning of each summer requires many vehicles travelling from San Francisco to transport equipment, and several vehicles remain at the site throughout the season. This site is roughly 170 miles from San Francisco and has very limited electrical capacity to accommodate charging infrastructure.

DESIRE FOR CITY LEADERSHIP & GUIDANCE

Given the complex nature of fleet electrification, and the need for collaboration and funding from multiple city departments, the fleet manager would benefit from a point-person within the city government to lead these efforts across departments.

San Francisco Municipal Transportation Agency

Vehicle Locations	Vehicle Count
650-698 6th St, San Francisco, CA 94103, USA	130
2323 Cesar Chavez St, San Francisco, CA 94124, USA	44
1501-1599 Michigan St, San Francisco, CA 94124, USA (MUNI Metro East)	32
800 Pennsylvania Ave, San Francisco, CA 94107, USA	28
1849 Harrison St, San Francisco, CA 94103, USA	27
600 V, San Francisco, CA 94103, USA	24
1554 Armstrong Ave, San Francisco, CA 94124, USA	24
1521 Wallace Ave, San Francisco, CA 94124, USA	20
293 Talbert St, Daly City, CA 94014, USA	18
36 Morris St, San Francisco, CA 94107, USA	14
10th St & Bryant St, San Francisco, CA 94103, USA	14
620 1st St, San Francisco, CA 94103, USA	14
1580 Burke Ave, San Francisco, CA 94124, USA	13
292 Talbert St, Daly City, CA 94014, USA	13
601 25th St, San Francisco, CA 94107, USA (MUNI Metro East)	12
700 700v, San Francisco, CA 94107, USA	10
826 Pennsylvania Ave, San Francisco, CA 94107, USA	10
1201-1399 Marin St, San Francisco, CA 94124, USA	10
49 S Van Ness Ave, San Francisco, CA 94103, USA	9
2830 Alameda St, San Francisco, CA 94103, USA	8
445 Harriet St, San Francisco, CA 94103, USA	8
29588 Ruus Rd, Hayward, CA 94544, USA	7
1561 Wallace Ave, San Francisco, CA 94124, USA	7
1301 Cesar Chavez St, San Francisco, CA 94124, USA	6
600 25th St, San Francisco, CA 94107, USA (MUNI Metro East)	6
575 10th St, San Francisco, CA 94103, USA	6
625 25th St, San Francisco, CA 94107, USA	5
400 Cargo Way, San Francisco, CA 94124, USA	5
1440 Bancroft Ave, San Francisco, CA 94124, USA	5
1830-1898 Harrison St, San Francisco, CA 94103, USA	5
1015-1021 Minnesota St, San Francisco, CA 94107, USA	5
101-141 Treat Ave, San Francisco, CA 94103, USA	5
1528 Yosemite Ave, San Francisco, CA 94124, USA	4
620 6th St, San Francisco, CA 94103, USA	4
1414 Bancroft Ave, San Francisco, CA 94124, USA	4
765 Pennsylvania Ave, San Francisco, CA 94107, USA	4
292 Talbert St, San Francisco, CA 94134, USA	4
355 McAllister St, San Francisco, CA 94102, USA	3
640 Cesar Chavez St, San Francisco, CA 94124, USA (MUNI Metro East)	3
8 Jennings St, San Francisco, CA 94124, USA	3
500 Geneva Ave, San Francisco, CA 94112, USA	3
2650 Bayshore Blvd, Daly City, CA 94014, USA	3
1338 Marin St, San Francisco, CA 94124, USA	3
Bryant St & 17th St, San Francisco, CA 94110, USA	3
2298 San Jose Avenue, San Francisco, CA 94112, USA	2
1201 Mason St, San Francisco, CA 94108, USA	2
San Jose Ave & Ocean Ave, San Francisco, CA 94112, USA	2
101 S Van Ness Ave, San Francisco, CA 94103, USA	2
1231 Mason St, San Francisco, CA 94108, USA	2
600-604 6th St, San Francisco, CA 94103, USA	2
25th Street and, Illinois St, San Francisco, CA 94107, USA (MUNI Metro East)	2
880 Pennsylvania Ave, San Francisco, CA 94107, USA	2
1200 15th St, San Francisco, CA 94103, USA	2
1029 Jackson St, San Francisco, CA 94133, USA	2
950 Bryant St, San Francisco, CA 94103, USA	2
1040 Minnesota St, San Francisco, CA 94107, USA	2
1948 Harrison St, San Francisco, CA 94103, USA	2
328 Ocean Ave, San Francisco, CA 94112, USA	2

66 Airport Access Rd, Oakland, CA 94603, USA	2
35 Tubbs St, San Francisco, CA 94107, USA	2
1252 Mason St, San Francisco, CA 94108, USA	2
1155 V, San Francisco, CA 94107, USA	2
1570-1580 Burke Ave, San Francisco, CA 94124, USA	2
1538 Yosemite Ave, San Francisco, CA 94124, USA	1
1700-1748 Indiana St, San Francisco, CA 94124, USA	1
726 Presidio Ave, San Francisco, CA 94115, USA	1
339 Division St, San Francisco, CA 94103, USA	1
1509 Wallace Ave, San Francisco, CA 94124, USA	1
1855 Folsom St, San Francisco, CA 94103, USA	1
1560 Yosemite Ave, San Francisco, CA 94124, USA	1
1923 W Winton Ave, Hayward, CA 94545, USA	1
8220 Baldwin St, Oakland, CA 94621, USA	1
1238 Mason St, San Francisco, CA 94108, USA	1
700 Pennsylvania Ave, San Francisco, CA 94107, USA	1
201 Alabama St, San Francisco, CA 94103, USA	1
45 Tubbs St, San Francisco, CA 94107, USA	1
2200 Jennings St, San Francisco, CA 94124, USA	1
Jackson St & Mason St, San Francisco, CA 94133, USA	1
400-498 Harriet St, San Francisco, CA 94103, USA	1
953 Harrison St, San Francisco, CA 94107, USA	1
2498 Powell St, San Francisco, CA 94133, USA	1
Townsend St & 6th St, San Francisco, CA 94107, USA	1
2505 Mariposa St, San Francisco, CA 94110, USA	1
950 Bryant St, San Francisco, CA 94103, USA	1
2584 Grant Ave, San Lorenzo, CA 94580, USA	1
Church St & Duboce Ave, San Francisco, CA 94114, USA	1
1265 Mason St, San Francisco, CA 94108, USA	1
1508 Yosemite Ave, San Francisco, CA 94124, USA	1
2620 Geary Blvd, San Francisco, CA 94115, USA	1
1144 1/2 Washington St, San Francisco, CA 94108, USA	1
2628 Geary Blvd, San Francisco, CA 94115, USA	1
930 Bryant St, San Francisco, CA 94103, USA	1
2630-2640 Geary Blvd, San Francisco, CA 94118, USA	1
501 Cargo Way, San Francisco, CA 94124, USA	1
2631 17th St, San Francisco, CA 94110, USA	1
1199 Mason St, San Francisco, CA 94108, USA	1
2634 Bayshore Blvd, Daly City, CA 94014, USA	1
575 10th St #402, San Francisco, CA 94103, USA	1
175 Bluxome St, San Francisco, CA 94107, USA	1
6621 Geary Blvd, San Francisco, CA 94121, USA	1
2710 16th St, San Francisco, CA 94103, USA	1
757 11th St, San Francisco, CA 94103, USA	1
1301-1399 Cesar Chavez St, San Francisco, CA 94124, USA	1
800-898 Cesar Chavez St, San Francisco, CA 94124, USA (MUNI Metro East)	1
550 Selby St, San Francisco, CA 94124, USA	1
855 Presidio Ave, San Francisco, CA 94115, USA	1
1399 Marin St, San Francisco, CA 94124, USA	1
Bryant St & 17th St (#13732), San Francisco, CA 94110, USA	1
1521 Wallace Ave, San Francisco, CA 94124, USA	1
Castro Station, San Francisco, CA 94114, USA	1
1120 Washington St, San Francisco, CA 94108, USA	1
Islais Creek Muni Park, 1700-1748 Indiana St, San Francisco, CA 94124, USA	1
1015-1021 Minnesota St, San Francisco, CA 94107, USA	1
35 King St, San Francisco, CA 94107, USA	1
1001 22nd St, San Francisco, CA 94107, USA	1
1554 Market St, San Francisco, CA 94102, USA	1
Total	**676**

FIGURE 21: SF MUNICIPAL TRANSPORTATION AGENCY – COUNT OF MDHD VEHICLES BY ADDRESS

Vehicle Type	Vehicle Count	Average Daily Mileage
Pickup	58	17.32
Truck	1	1.60
Van	2	2.34
Total	*61*	

FIGURE 22: MDHD VEHICLES BY TYPE AND AVERAGE DAILY MILEAGE MUNI METRO EAST

SFMTA INTERVIEW DETAIL

The initial interview consisted of a video conference to discuss the department's fleet, parking locations, and opportunities and challenges around fleet electrification. A second, on-site interview took place at the MUNI Metro East Maintenance Facility (MME – Figure 23). This location is headquarters for the agency's Street Operations fleet, which consists of 40 pickups and may be the best candidate for early electrification of medium-duty vehicles.

SFMTA's Fleet Director has initiated some work to begin electrifying the agency's light duty vehicles, beginning with 13 Chevy Bolts across several parking locations. Upon procuring these first EVs, the Fleet Director had to engage with SFMTA's Capital Programs & Construction (CP&C) team to request resources for charging infrastructure.

MUNI Metro East is a high-priority site for charging infrastructure because of the high number of pickups domiciled there and the overall size of the parking lot. Vehicles in the Street Operations group see the highest number of average daily miles driven. MME also serves as a railyard for MUNI cars. Though the main electrical service panel was unable to be located during the site visit, Potter suspects that the electrical service is robust and could accommodate many EV chargers. Further analysis by the San Francisco Public Utilities Commission (SFPUC) found that there was additional capacity to add an additional 192 Level 2 chargers to the site.

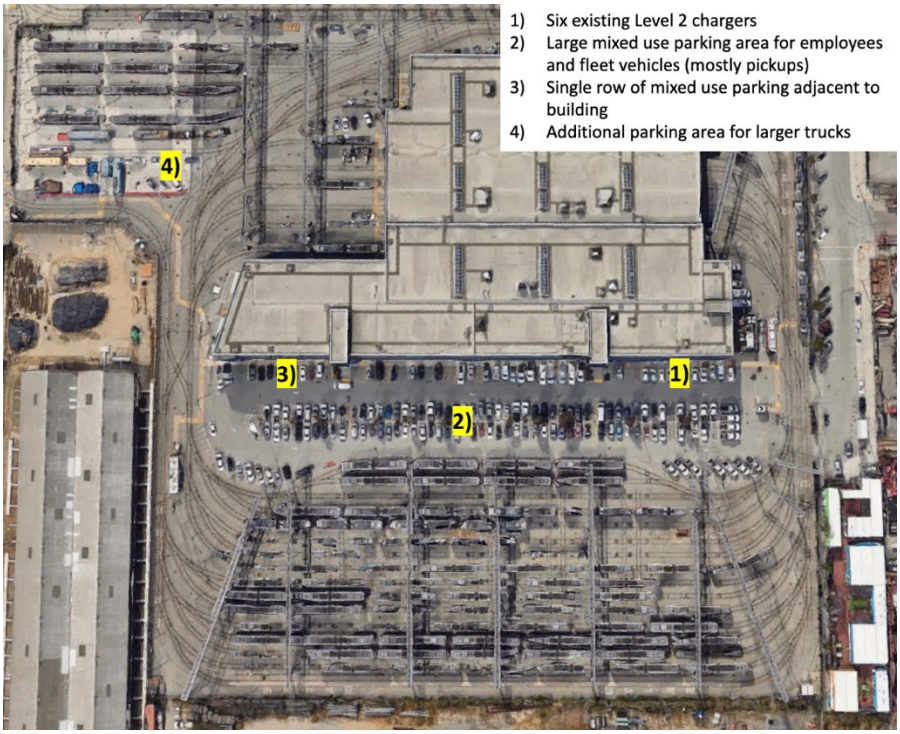

FIGURE 23: AERIAL VIEW OF MUNI METRO EAST

MTA's Fleet Director detailed several key challenges the department faces in procuring electric vehicles and installing charging infrastructure.

FUNDING

SFMTA's budget process is separate from fleets that receive the City's General Fund, which allows the fleet director to advocate for funds to procure vehicles, but another team is responsible for infrastructure and facilities. This has led to challenges for the fleet director in coordination with the facilities team, as each electric vehicle procurement must also include consideration for the adequate charging infrastructure.

VEHICLE MODELS & AVAILABILITY

Besides the Street Operations vehicles, which consist of many smaller pickups, SFMTA has several vehicle types with specific capabilities that might be difficult for an EV to accommodate. For example, about 35 vehicles are equipped to drive on tracks to access and service the city's rail infrastructure. There are also several larger trucks with power take-off units like bucket lifters to perform critical work. Right now, that equipment is often powered by the truck's internal combustion engine (ICE), but with an EV those loads might put extra pressure on the vehicle's battery capacity.

DESIRE FOR CITY LEADERSHIP & GUIDANCE

SFMTA's organizational structure makes fleet electrification especially challenging, as one team is responsible for vehicle procurement while another is responsible for infrastructure and facilities. This presents a gap in communication and an opportunity for city leadership to help facilitate the transition to EVs.

RELIABILITY OF EVS FOR EMERGENCY RESPONSE

The Fleet Director expressed some concern about backup power and the capacity to charge vehicles during emergency situations like earthquakes or outages due to severe weather.

San Francisco Department of Public Works

Vehicle Locations	Vehicle Count
2323 Cesar Chavez St, San Francisco, CA 94124, USA (DPW Yard)	207
2077 Cesar Chavez St, San Francisco, CA 94107, USA	138
1601-1699 Kansas St, San Francisco, CA 94124, USA (DPW Yard)	49
Parking lot, 2323 Cesar Chavez St, San Francisco, CA 94124, USA	45
123 Napoleon St, San Francisco, CA 94124, USA	24
160 Napoleon St, San Francisco, CA 94124, USA	16
1902-1998 Evans Ave, San Francisco, CA 94124, USA	11
1900 Evans Ave, San Francisco, CA 94124, USA	11
2575 Marin St, San Francisco, CA 94124, USA	9
255 12th St, San Francisco, CA 94103, USA	6
8212 Evans Ave, San Francisco, CA 94124, USA	6
555 Selby St, San Francisco, CA 94124, USA	5
680 Bryant St, San Francisco, CA 94107, USA	3
680 Bryant St, San Francisco, CA 94107, USA	3
2190 Cesar Chavez St, San Francisco, CA 94124, USA	3
2323 Cesar Chavez, San Francisco, CA 94124, USA (DPW Yard)	3
2027 Newcomb Ave, San Francisco, CA 94124, USA	3
1950 Innes Ave, San Francisco, CA 94124, USA	2
45 Twin Peaks Boulevard, San Francisco, CA 94114, USA	2
455 Mission Bay Blvd S, San Francisco, CA 94158, USA	2
Unnamed Road, San Francisco, CA 94124, USA	2
Parking lot, 1976 Innes Ave, San Francisco, CA 94124, USA	1
1515 S Van Ness Ave, San Francisco, CA 94110, USA	1
1940 Evans Ave, San Francisco, CA 94124, USA	1
Evans Ave & Cesar Chavez St, San Francisco, CA 94124, USA	1
550 Selby St, San Francisco, CA 94124, USA	1
395 13th St, San Francisco, CA 94103, USA	1
555 Selby St, San Francisco, CA 94124, USA	1
Sloat Blvd & 36th Ave, San Francisco, CA 94116, USA	1
1975 Galvez Ave, San Francisco, CA 94124, USA	1
1235 Mission St, San Francisco, CA 94103, USA	1
16 Bird St, San Francisco, CA 94110, USA	1
2029 Newcomb Ave, San Francisco, CA 94124, USA	1
29588 Ruus Rd, Hayward, CA 94544, USA	1
2045-2255 Cesar Chavez St, San Francisco, CA 94107, USA	1
500 Selby St, San Francisco, CA 94124, USA	1
130 S Linden Ave # H, South San Francisco, CA 94080, USA	1
1906 W Winton Ave, Hayward, CA 94545, USA	1
2090 Cesar Chavez St, San Francisco, CA 94124, USA	1
123 Napoleon St, San Francisco, CA 94124, USA	1
1515 Broadway, San Francisco, CA 94109, USA	1
Pier 96 gatehouse, San Francisco, CA 94111, USA	1
1975 Galvez Ave, San Francisco, CA 94124, USA	1
420 5th St, San Francisco, CA 94107, USA	1
2025 Newcomb Ave, San Francisco, CA 94124, USA	1
196 Napoleon St, San Francisco, CA 94124, USA	1
Total	**575**

FIGURE 24: SF DEPARTMENT OF PUBLIC WORKS – COUNT OF MDHD VEHICLES BY ADDRESS

Vehicle Type	Vehicle Count	Average Daily Mileage
Pickup	173	11.89
Small Offroad	2	
Trailer & Misc	4	
Truck	55	18.13
Van	25	5.42
Total	*259*	

FIGURE 25: MDHD VEHICLES BY TYPE AND AVERAGE DAILY MILEAGE, DPW YARD

DPW INTERVIEW DETAIL

The initial interview consisted of a video conference to discuss the department's fleet, parking locations, and opportunities and challenges around fleet electrification. A second, on-site interview took place at the DPW Yard. This location is home to most of the department's fleet vehicles.

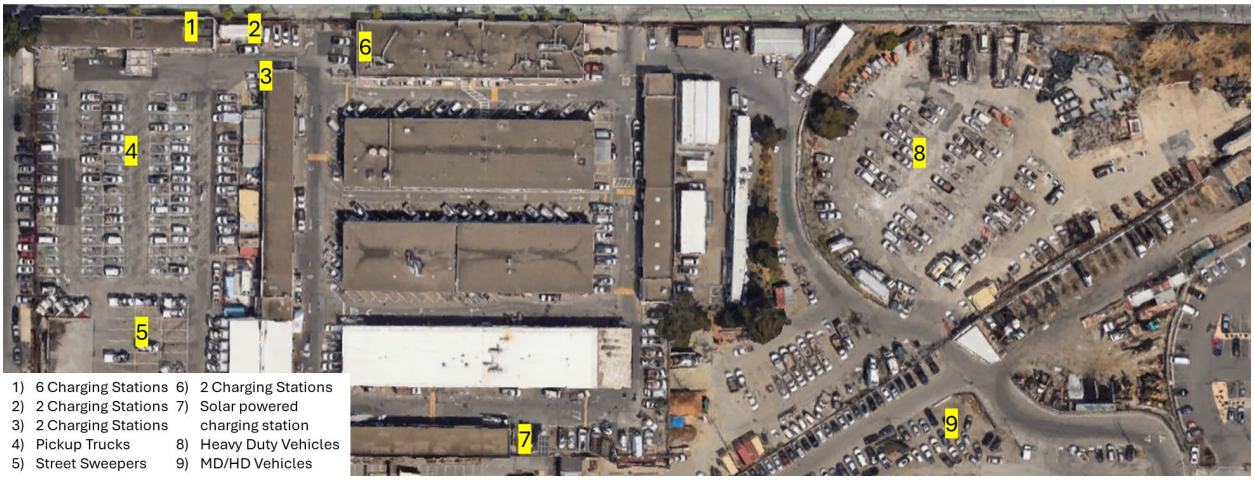

FIGURE 26: AERIAL VIEW OF DPW CESAR CHAVEZ YARD

DPW has initiated some work to begin electrifying the agency's light duty vehicles, and most recently ordered Ford electric pickups. The Heavy Equipment Operations Supervisor has begun exploring new models of EVs for the MDHD fleet, including attending a Peterbilt event for tractor trailers.

The DPW Yard is a high-priority site for charging infrastructure because of the high number of pickups domiciled there (Figure 26).

There are currently roughly 14 Level 2 chargers at the site, and an additional 3-4 chargers in an adjacent employee parking lot. At this time, the site's electrical capacity is insufficient to accommodate any more charging infrastructure, and the department has been told by the utility that service upgrades may take at least 18 months.

DPW's Heavy Equipment Operations Supervisor detailed several key challenges the department faces in procuring electric vehicles and installing charging infrastructure.

FUNDING

DPW's fleet is one of the largest in the city, and the cost of new MDHD EVs are expensive. The additional costs and long lead time for electrical service upgrades at the DPW Yard are also key barriers.

VEHICLE MODELS & AVAILABILITY

DPW's fleet has many vehicles that use power take-off units to perform critical work. Right now, that equipment is often powered by the truck's ICE engine, but with an EV those loads might put extra pressure on the vehicle's battery capacity. The operations supervisor has also seen demonstrations of street sweepers that were not able to drive up steep grades, making them a poor fit for many of San Francisco's streets.

RELIABILITY OF EVS FOR EMERGENCY RESPONSE

There is some concern about backup power and the capacity to charge vehicles during emergency situations like earthquakes or outages due to severe weather. In many emergency situations, DPW is responsible for emergency response and vehicles may be expected to operate 24/7 until critical services are restored.

Appendix G: Charging Suitability Mapping Tool and Data Collection and Prioritization

SF Environment completed several stages of data collection and engagement to develop the mapping tool. Data was gathered from public or City-managed sources and were selected because of ease of availability as well as relevance to the goal of siting MDHD EV charging infrastructure. Arup led a workshop on January 30, 2024 for City staff to begin thinking about how to prioritize the given layers within a larger suitability analysis. then used an Analytic Hierarchy Process to weight the criteria for the multi-criteria analysis process. The resulting tool is robust enough for the City's utility companies, including the SFPUC and PG&E, to identify priority grid upgrade needs for MDHD EV charging. At the same time, there is room to build an even more robust tool that could include data purchased from private companies—as well as additional publicly available information. Please see the accompanying Appendix G *Data Collection Plan*, *Data Collection and Analysis Report*, and *Charging Infrastructure Map and Narrative* for a detailed explanation on the development of the tool.

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